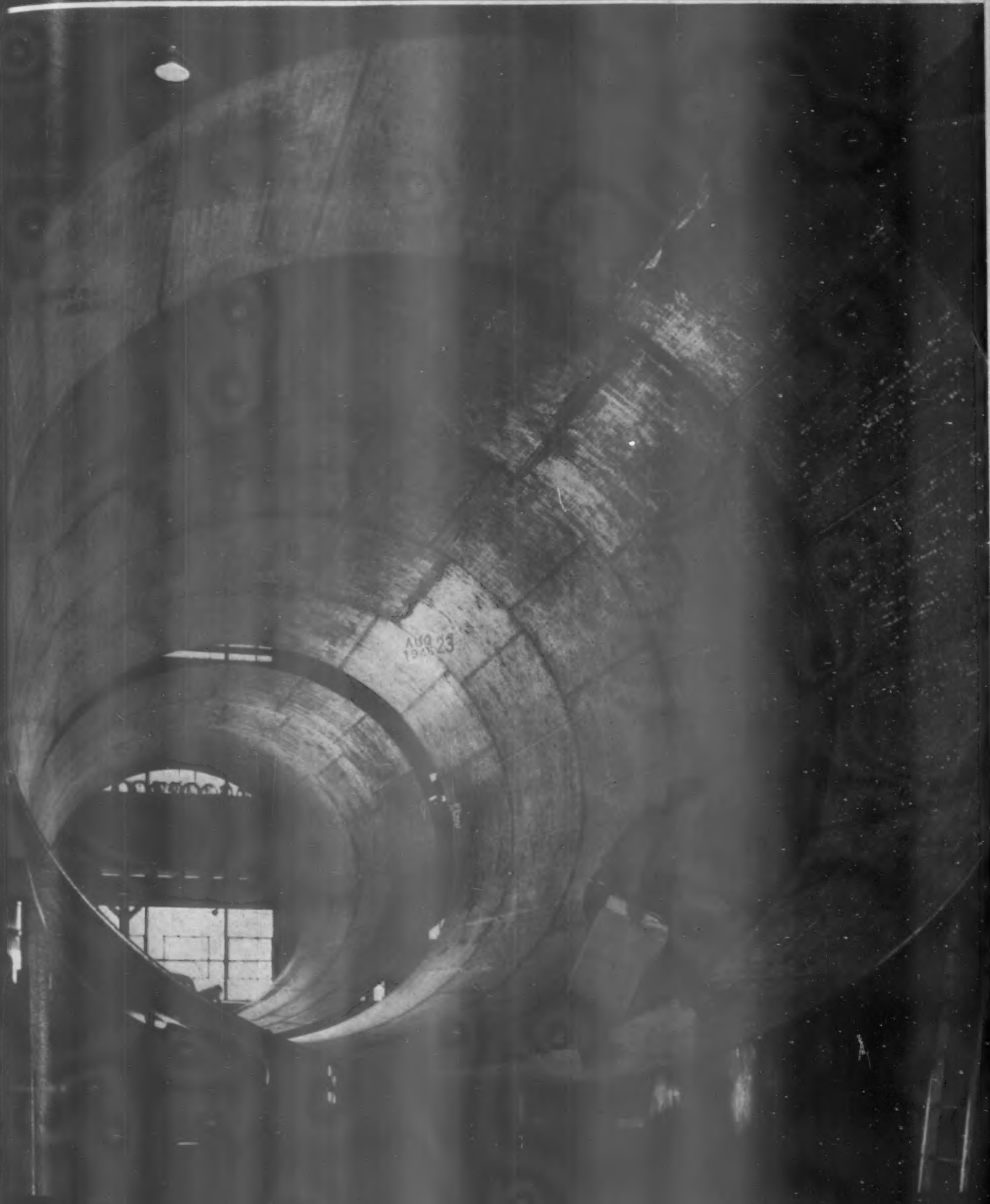
AUGUST, 1946

THE WELDING ENGINEER

A PIONEER TECHNICAL PUBLICATION OF THE WELDING INDUSTRY

AUG 23 1946



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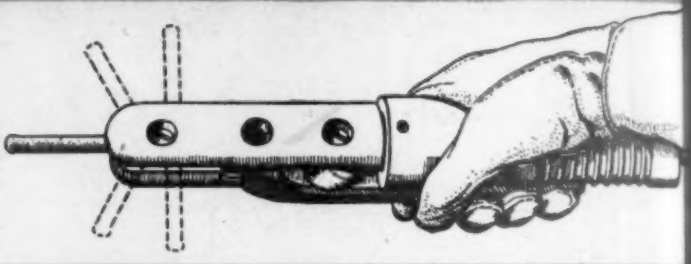

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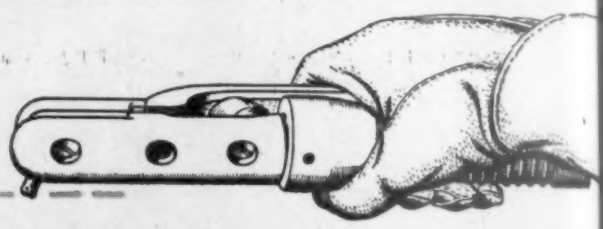

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The largest shop-fabricated pressure vessel ever made—16 ft diam, 108 ft 8 in. long. Stainless-clad plate 55/64 in. thick was welded to make this shell. Courtesy, A. O. Smith Corp.

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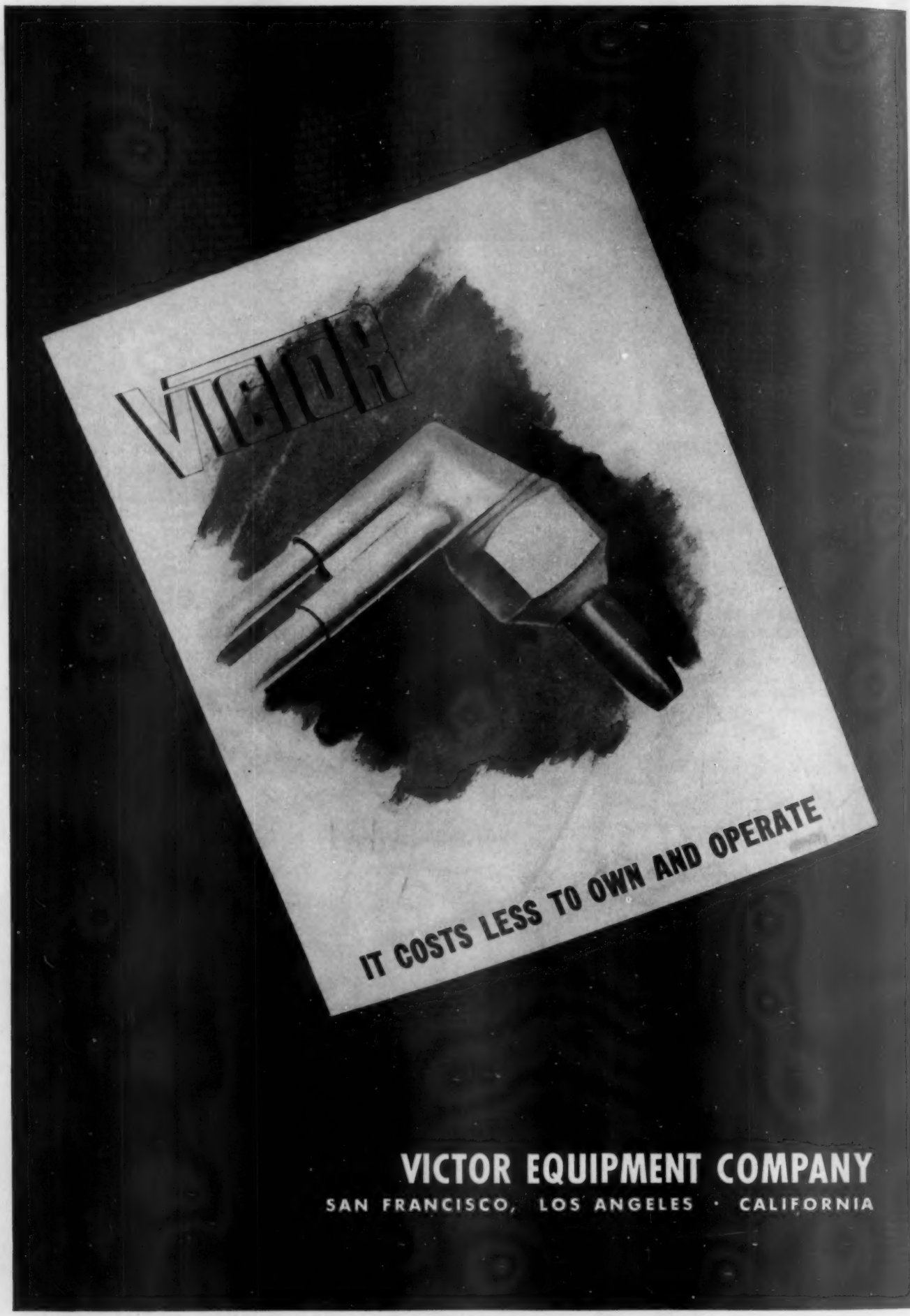
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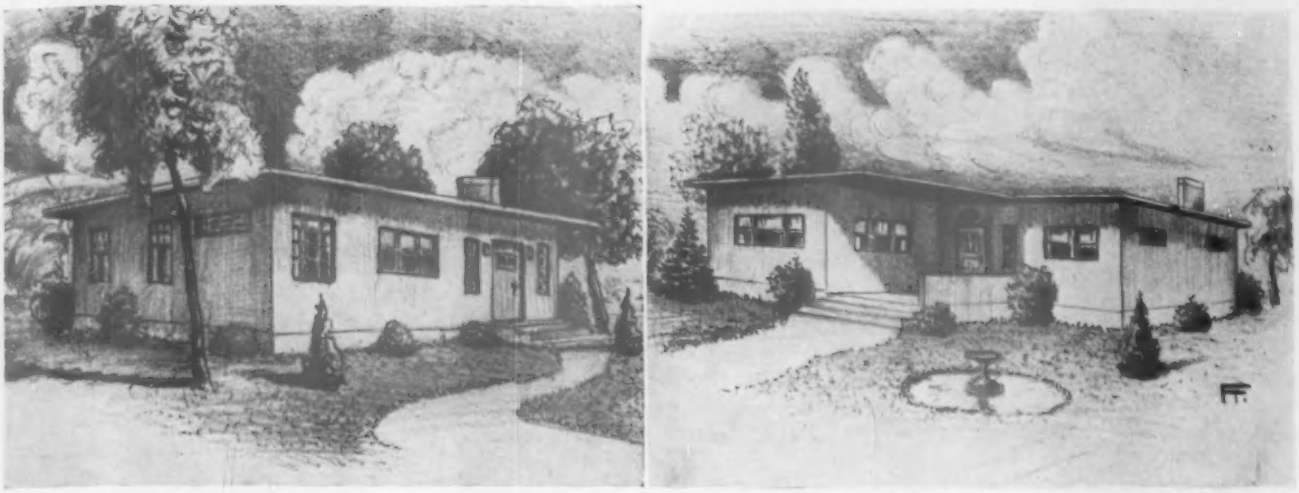

These attractive homes could be mass-produced without sacrifice of the owner's individual tastes and preferences

Can We Have SPOT-WELDED HOUSES?*

BY ALFRED FETZ, Welding Engineer, Detroit

The assembly fixture and the portable spot welder can do for house construction what they did for automobiles, if the public can be sold on mass-produced steel houses.

DESIGNERS and industry are developing new ideas and methods to meet the steeply rising demand curve of desperate home seekers. Uppermost in these new designs seems to be the commendable desire to cut construction time as much as possible in order to produce houses at reasonable prices. All of these ideas have their distinctive merits from the designers' and manufacturers' points of view, but what counts in the end is the reaction of the public. It would be foolish for anybody to manufacture even the most perfect product if potential buyers aren't ready to accept it. Are they ready to accept spot-welded steel houses?

Mr. Elvin Stouffer touches upon the $64 question in an article, "Buyers Reject Economy Ideas," recently published in the Detroit *Free Press*. Admitting, by implication at least, that he has not yet found anything that would be satisfactory to the public in general, the writer asks himself: "Why are houses being built in almost the same way as 50 years ago when new methods and tools are available?"

At least a partial answer is furnished by Mr. Stouffer in a quotation from Clair Ditchy, president of the Detroit Chapter of the American Institute of Architects. "The American public," declares Mr. Ditchy, "has a natural resentment against anything connected with house building that is not strictly conventional, and, secondarily, industry has not seen fit to explore the need of new building tools."

In the first part of this statement, we have the reason why even good new ideas in home design have been (or will be) rejected. Automobile designers know from long experience that they cannot make too radical changes in car design because of the inherent conservatism of the great mass of buyers. Likewise the prospective home owner's whims and crotchets have to be carefully considered in order to make a new design for houses a success.

TODAY'S BASIC REQUIREMENTS

Mass-production methods must be used to hold the construction cost low. Notwithstanding, the design must be flexible so that it can be adapted to satisfy the taste of the individual builder. To these two requirements should be added a third: the new homes should be provided with all possible safety devices to give the highest degree of protection in case of war. Undoubtedly, there are different ways to reconcile these three objectives. The method discussed in connection with the accompanying sketches (for which patents are pending) is noteworthy in that it

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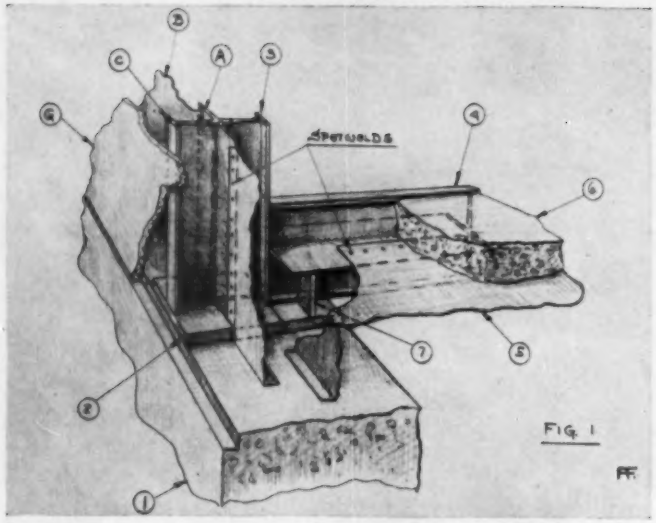


Fig. 1—New-type F-beam in wall and floor construction. (1) foundation; (2) small steel plates; (3) beam used as stud; (4) beam used as floor beam; (5) and (B) sheets spot welded to beam flanges (A); (6) concrete floor; (7) foot or locator for floor beams; (C) smaller flanges to which inside and outside (G) walls are attached

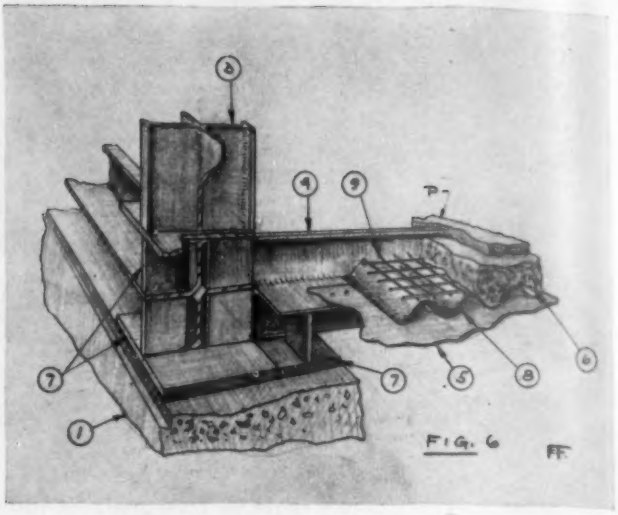


Fig. 6 — Modified type of construction using standard F-beam as studs (3) and floor beams (4). The locators (7) are turned upside down to provide a foot for the stud

takes full advantage of the experience gained in the mass production of automobiles.

Take away the assembly fixture and the resistance welder, and the automobile assembly line will be dead. These are the tools that made the mass production of cars possible, and they can be used to the same advantage in the production of houses.

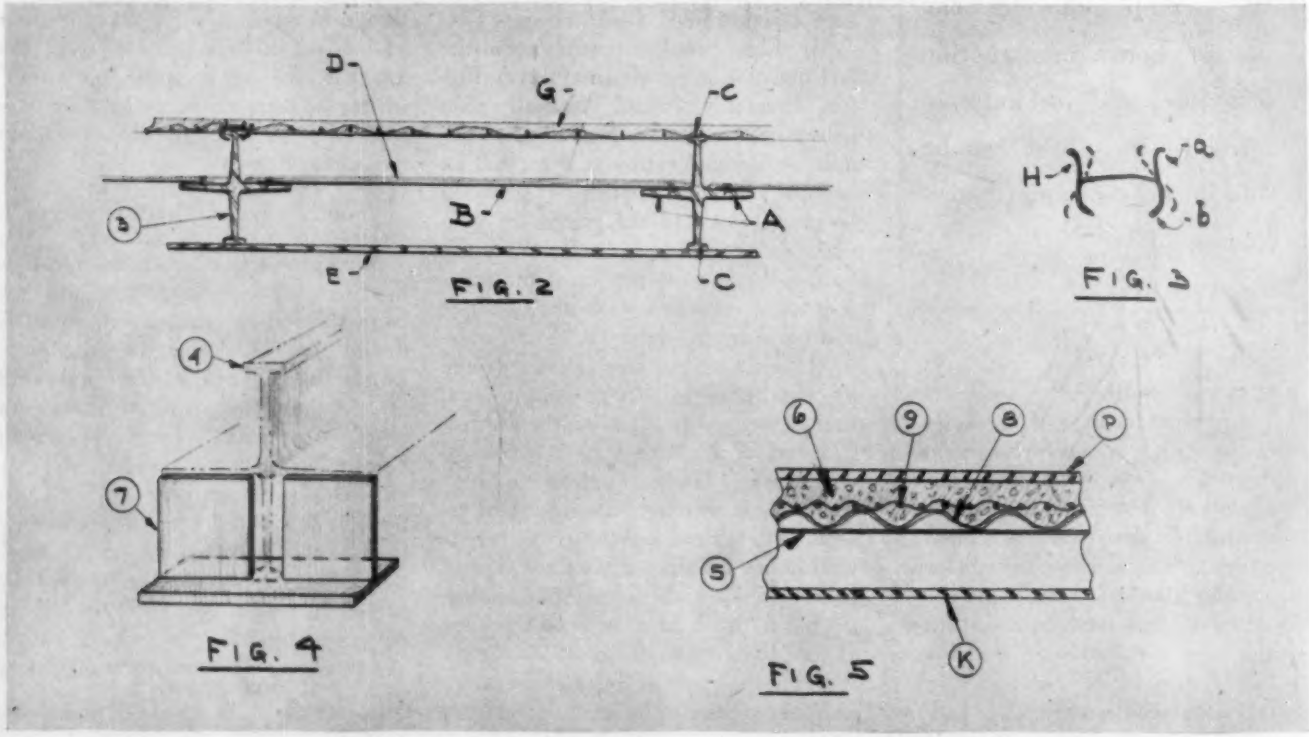
In spite of the fact that mass-production methods are used in the construction of this type of house, each home on a street could be built differently. The accompanying drawings show two of the many types of houses possible; the number of variations is limited only by the imagination of the designer.

Fig. 2—How inside (E) and outside walls (G) are attached to the two smaller flanges (C) of the F-beam (3); (D) indicates the blanket of insulating material

Fig. 3—Clip (H) to hold a brick wall or metal lath to the steel frame; (*b*) prongs, (*a*) fingers. See Fig. 9

Fig. 4—Detail of floor beam construction (see also Fig. 1). (4) F-beam; (7) foot or locator

Fig. 5—Detail of roof or floor section. (P) plastic floor finish; (5) spot-welded sheets; (6) concrete floor; (8) corrugated sheet metal; (9) wire mesh; (K) ceiling



New-type Steel Beam

Let us now consider the construction details in the sketches. Fig. 1 illustrates the application of a new type of beam rolled with an extremely light section as a stud in wall construction (3) and as a floor beam (4). This beam will be referred to in the following discussion as the F-beam. On a foundation (1), small steel plates (2) are placed as base plates for the studs (3). To assure a speedy assembly of the frame of the house, these studs will be spaced and held in position by fixtures made from fabricated light-metal sections and holding clamps.

These fixtures will be removed as soon as the frame of the building is assembled. The application of fixtures does not mean that all houses are to be alike, since the fixtures are easily changeable to permit any variation in the design of buildings. The purpose of the fixtures is to locate and hold in position standard parts for speedy assembly. For this reason they are made light and simple.

The Welder and the Carpenter

Light-gauge sheets (B) are placed like wall paper on the flanges (A) of the F-beam and are spotwelded to the steel flanges with series welding guns. To illustrate the speed with which this welding will be carried out, let us compare it to the nailing of wooden frames. Since we are series welding, we are getting two spots with every stroke of the welder, and the welding time will be about 6 cycles or 1/10 second for the two spot welds. This means that two welds are being performed at every single hammer blow of a carpenter on the head of the nail. In the same time that it takes a carpenter to drive one nail into position, the welder will have made at least 10 to 16 welding spots. This alone will cut the time ordinarily spent by a carpenter on a building by 10 to 16 times. Furthermore, we do not need nearly as many spot welds on a steel structure as we need nails on a wooden building. The strength of these welds is such, let us remember, that a button will have to be torn out of the steel in order to separate the two welded sheets. The automobile body is held together by spot welds, and these hold even though they are subjected to varying stresses far in excess of what the statically loaded home will require.

After the sheets have been spot welded to the F-beam, they are sprayed with a protective metal paint which serves as a sealing medium and also as a glue for the blankets of insulating material which are to be attached to one or both sides of the partition. The insulation of the house does not depend exclusively on the use of these blankets of insulating material since two air pockets are built into the building because of the design of the F-beam. For the construction of the inside and outside of the wall, different methods can be used to suit the builder, who may either stick to conventional ideas or adopt a modern design.

Methods for Attaching Walls

Fig. 2 shows the two smaller flanges (C) to which the inside and outside walls are being attached. If the home owner prefers shingles, they will be hung to steel bars spot welded across flanges (C). If preference is given to brick, a clip (H) made from spring steel (see Fig. 3) will be used to hold the brick wall to the steel frame. The prongs of this clip snap over the flanges when the two fingers are pushed together. The fingers will later be embedded in mortar (illustrated in Fig. 9), which hardens and prevents the clip from opening.

Other methods of wall construction are obtained by the use of wire mesh, metal lath or wall boards as a base for stucco, concrete or plastic. The wire clip described above will hold the wire mesh or metal lath against the F-beam until they can be spot welded to it for greater strength. The use of the clip alone might be enough since it will be frozen into position as soon as the covering material, which will be applied with a spray gun, has hardened. Should wall or fiber boards or any other material of this kind be used as a base, welding guns of special design will be employed to give a strong bond

Fig. 7—Corner construction. The outer (12) and inner (13) corner rails are welded to strips (10 and 11) spot welded to the F-beam (3). The sheet-metal partition (B) is also welded to the flange of the F-beam

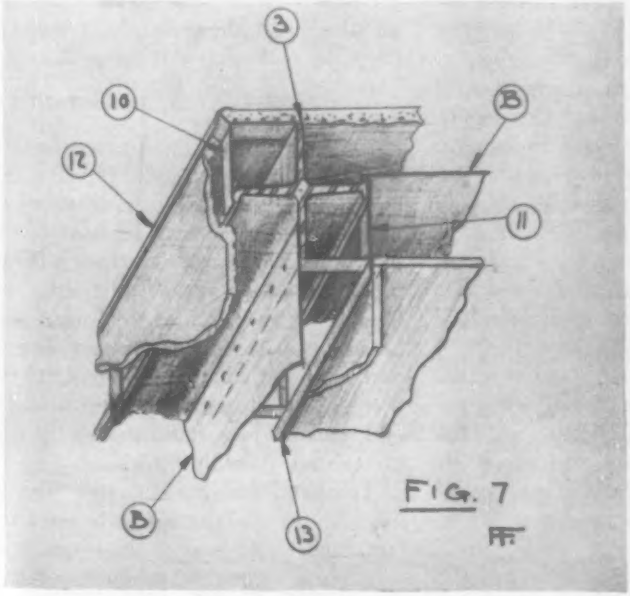
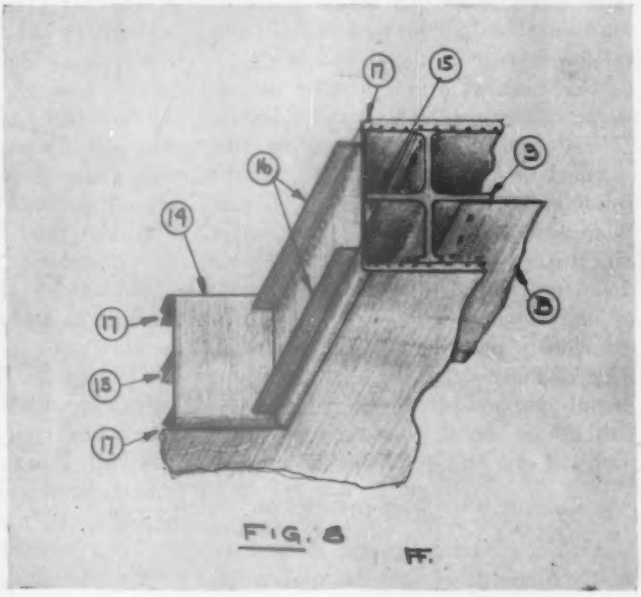


Fig. 8—Design of prefabricated steel window frame. The frame (14) is spot welded to the U-shaped channel (15) and to the outside flanges (17). The flanges (16) are for locators and base of the inner window frame



between the boards and steel and assure again a high speed of production.

The construction of the inside walls will be similar since we have the choice of using wire mesh, metal lath, wall board, plaster board or similar material as a base for plaster or plastic. It is again the customer who will make the choice, and the designer and contractor must be able to comply with his wishes. No matter which type of wall construction the buyer prefers, he will be given the benefit of saving through the application of mass-production methods and tools.

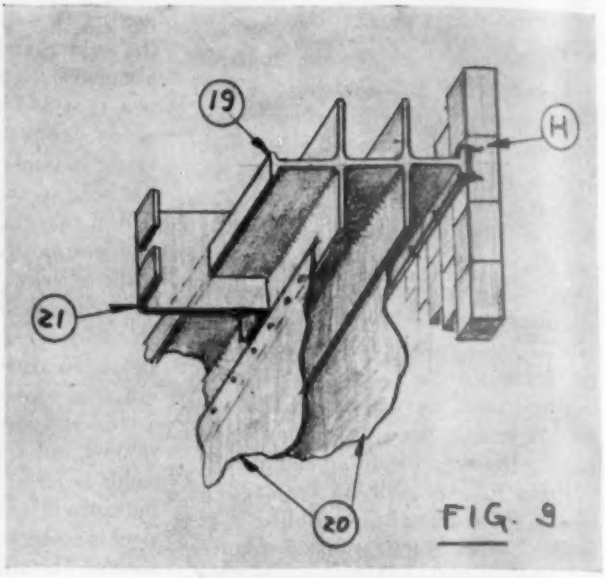


Fig. 9—Use of a double F-beam (19) with two spot-welded sheets (20) and prefabricated steel bracket (21)

Floor and Roof Construction

To locate and position the floor beams, a foot or locator is used; this is shown by (7) of Figs. 1, 4 and 6. The metal sheets (5) are spot welded to the flanges (A) of the F-beam and folded over at the foundation to form a pocket which will later be filled with concrete. The concrete will serve as a bond between the studs, the floor beams and the foundation. To strengthen the flooring, corrugated sheet metal and wire mesh may be placed above the spot welded sheets as shown in Figs. 5, 6 and 10. A plastic finish may be laid over the concrete, giving a flooring like linoleum in various patterns and colors.

To increase the insulating qualities of floors and roof, insulating blankets may be attached to the lower side of the sheet metal. Details of roof construction are given in Fig. 5. Onto the downward pointing flanges (C) of the F-beam, the ceiling (K) will be fastened, using the same kind of construction and material as is used for the inside walls. With this design, a strong and durable floor or roof is attainable at low cost in material and labor.

Fig. 6 shows a modification in construction, using the standard F-beams. The floor beam and its locators (described in Fig. 4) are resting on the foundation of the building. To provide a foot for the stud, the locators are turned upside down and placed over the F-beam resting on the foundation. The floor beams will be used as previously described in the construction of the floor, except that the sheet metal spot welded to the flanges (A) will not be bent down to the foundation but will rest on the flanges all around.

Corner and Window Frame

Fig. 7, a section through the corner of the house, illustrates the application of an outer and inner corner rail. These metal rails are welded to strips which are, in turn, spot welded to the F-beam. This permits a solid corner connection for the inside or outside walls regardless of the type of construction used (with the exception of brick and shingles).

Fig. 8 shows the design of a prefabricated steel window frame. The U-shaped channel (15) is gun welded to the flanges (A) of the F-beam and locates the window frame in the structure of the building. A tight-fitting solid connection between window frames and the steel structure of the house is assured by this design. To leave the choice of a wooden or steel inner window frame to the builder, the flanges (16) are provided for use as locators and base.

For those who wish to go all the way in this modern design, a new type of window will be available. The outside flanges (17) serve to blend the window frame into the finish of the walls with smooth surfaces on both sides. Should a builder intend to use glass brick in the construction of this house, flanges (16) will be omitted and the frame opening in any desired dimension will be filled out with the glass bricks.

The sketches so far have shown that no matter which type of wall construction is preferred in connection with the standard F-beam, two insulating air pockets are created by the sheet-metal partition (B) and the insulating blankets (D) fastened onto it.

A modification in the design of the F-beam (Fig. 9) may be used in cases where greater wall strength and higher insulating qualities are called for. In this sketch, one more set of flanges has been added to the F-beam, which will be used now with two metal sheets spot welded to these flanges. Another modification is a prefabricated bracket welded to the F-beam to support and position the floor beams of the secondary story of a building. The F-beams rest on these brackets in the same way as they do on the locator (7) of Fig. 4.

Fig. 10 illustrates the construction of the roof section and upper wall. The standard F-beam is cut to sections of length determined by the spacing of the studs and spot welded to the studs and locators for the roof F-beams, which are placed on the ends of the studs. In all other ways, the principle of design is the same as discussed before.

Architect Still Important

This type of steel house construction does not eliminate the need for the architect but leaves him undisturbed in his important rôle of consultant to the home owner who wishes to have a house built to meet his ideas and tastes. The chief difference is that steel parts will be set up as standards (the number of parts can and will be kept small) to replace wood. Steel gives greater strength and, equally important, makes the use of resistance welding possible.

Architect and builder will find it much to their advantage to become accustomed to the use of these new materials and high-speed production tools.

This is the same change that was made in the automobile industry when the old-style "buggy" became the modern all-steel body. The builder still has the opportunity to design homes to suit individual preference in style and wall construction. The customer may have any architectural style from the Colonial to ultra-modern. The combination of steel and plastic assures a high-quality, long-lived fireproof building.

Protection against Atomic Bombs

Speed in construction and flexibility in design are by no means the only advantages of this building method. Several months ago "photos" were published in one of our picture magazines showing the "ruins" of the completely leveled city of New York; the atomic bombs that were supposed to have been dropped left only the stone lions in front of the library to serve as a landmark. A picture of this kind of complete destruction is bound to give a feeling of utter helplessness against the power of the atomic bomb. After reading the report of Major De Seversky however, the author believes that it is possible to give a great deal of protection even against this deadliest of all bombs.

"The type of destruction was entirely incendiary in character," Major De Seversky reported on the effects of the atomic bombs exploded over Hiroshima and Nagasaki. "The deaths were due almost entirely to fire and falling structures . . . Concrete buildings, even in the very heart of the bomb explosions remained erect . . . even fragile objects on such buildings are still standing . . . Had there been modern concrete and steel cities, there would not have been such tremendous loss of life."

When most of us retire at night to our comfortable homes, we might just as well live in a matchbox as far as the effects of atomic or incendiary bombs are concerned. But we could build homes which would give a great deal of protection at little if any increase in price. The construction we have just described has the sturdiness only steel can give.

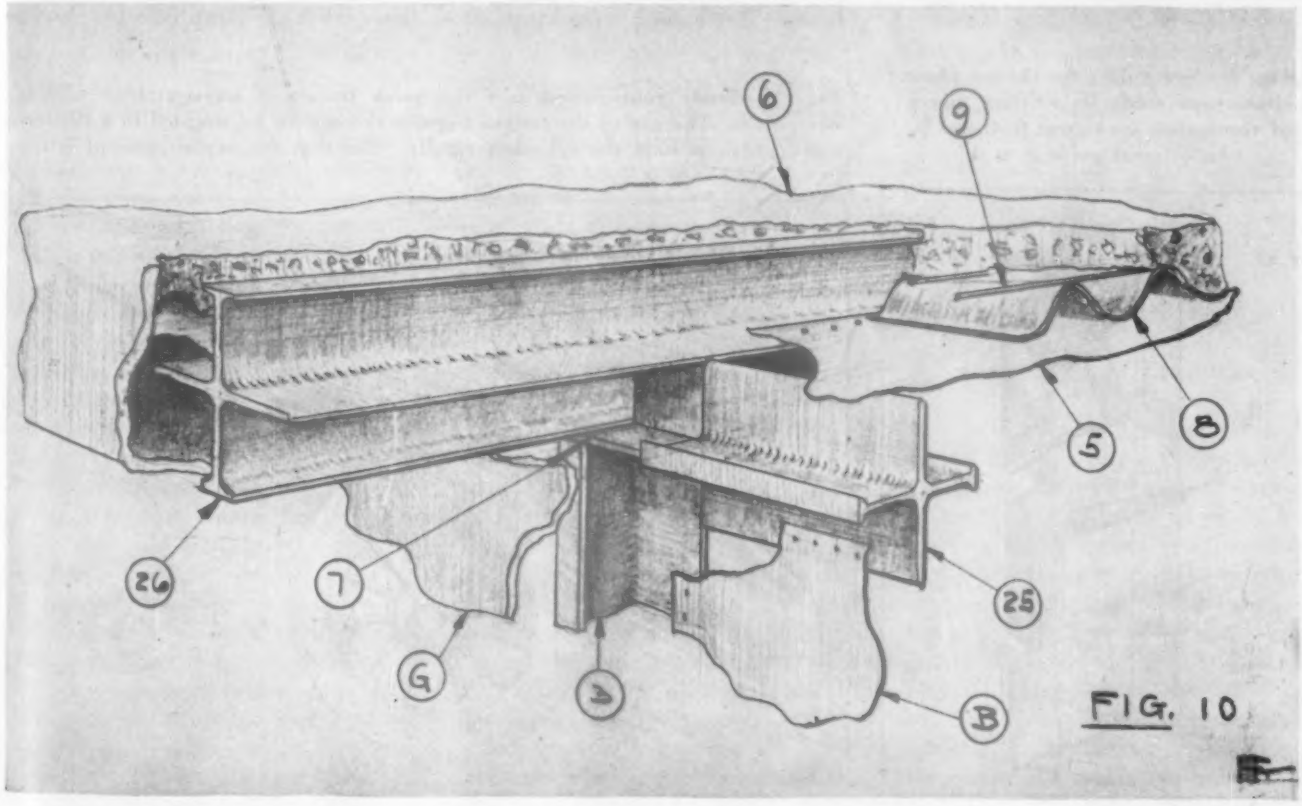
Suppose that intense heat waves are expected to result. To guard against them, we can use asbestos blankets on the sheet-metal partitions of our design. Furthermore, the concrete used on the outside of the house may be given the same refractory characteristics of a furnace lining. Suppose that we get a momentary but very destructive gamma radiation from atomic bombs. We will be able to protect ourselves, to some extent at least, by using lead preparations on the sheet-metal partition of the steel house. In case the atomic bomb also has a poison-gas effect (as predicted lately), the steel house can be built airtight. To give an even greater amount of protection, the design shown in Fig. 9 could be used and made more elaborate.

Tools and Material

The time has come when the pressing needs of the day are demanding new materials, new tools and new methods for the building industry. Steel mills with their modern equipment are able to produce on a mass-production scale any part called for in steel house construction. This means a comparatively low price for the most important material. Steel and plastic could very well be the dominating building materials of the future.

As a mass-production tool, the resistance welder has proved its speed and efficiency in the airplane and auto industries. Welding machines are ready and waiting for the building industry to use to assure rapid and economical fabrication of houses.

Fig. 10—Construction of roof section and upper wall. The standard F-beam is cut to sections (25) and spot welded to the studs (3) and to the locators (7). The roof F-beams (26) are then placed on the ends of the studs



★ MAINTENANCE

Welding in Institution Maintenance

BY OSCAR MARQUARDT
Master Mechanic, Menard Div., Illinois State Penitentiary, Menard, Ill.
As told to GEORGE HOLMAN

Mr. Marquardt tells of the development of welding at a state institution from an adjunct to the blacksmith shop to an indispensable maintenance tool.

THE THEN infant art of metal fusion came to the Menard branch of the Illinois Penal System back in 1920. An oxy-acetylene welding torch and a cutting torch were purchased in that year, together with necessary tips and pressure gauges. Three kinds of welding wire were obtained: a square cast-iron rod for welding cast iron, a yellow brass rod for brazing and a mild-steel rod which was used to weld everything that looked like wrought iron or steel.

The above welding outfit was assigned to the blacksmith shop, where for years it remained the unhappy stepchild of the hammer and tongs. Instead of being looked upon as a skilled artisan in his own right, the weldor was also helper to the two blacksmiths. It was not enough for him to know how to fuse metal—he was also required to swing a 16-lb sledge for heavy cut-offs and make ordinary welds on a forge.

The number of welds the blacksmiths made was great enough. Quarry cars broke their axles. Farm machines broke down. Parts of these and broken gadgets from other parts of the institution were brought to the blacksmith shop to be welded. If at all possible—and no

Fig. 4—New guides for the ice plant chute were made by welding pieces of automobile springs at B, C and D. An original guide is at A

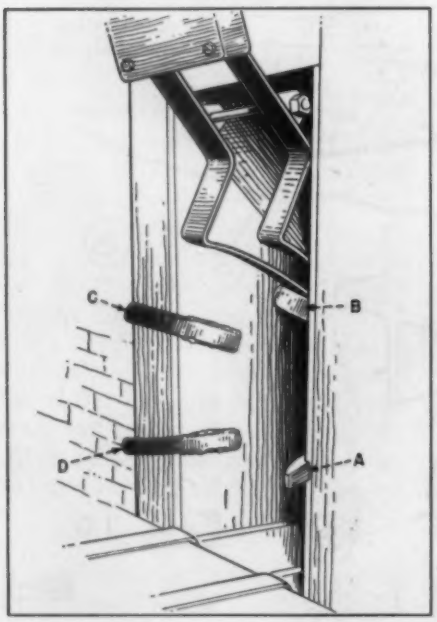
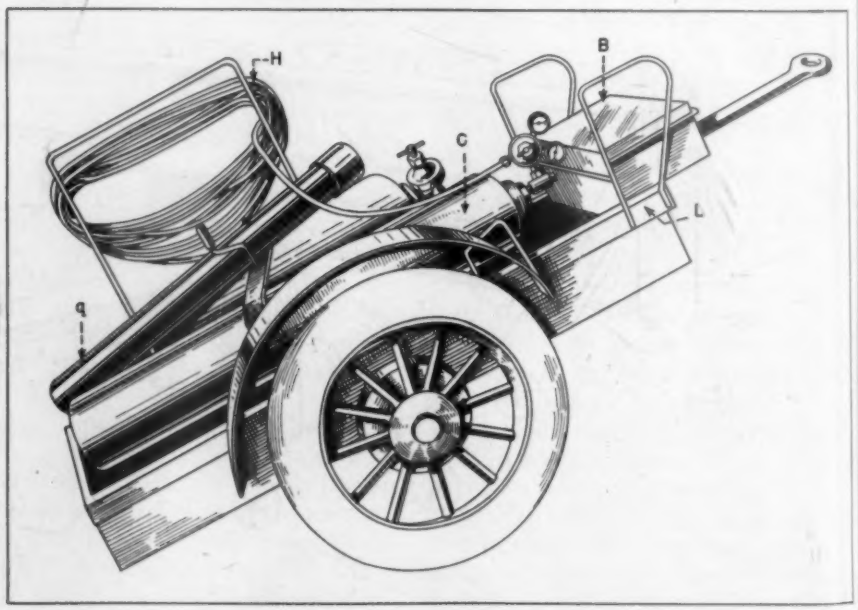


Fig. 1—Handy rubber-tired cart for quick transit of oxy-acetylene welding equipment. The eye in the tongue permits the cart to be coupled to a delivery truck. Clamps hold the cylinders rigidly. See text for explanation of letters



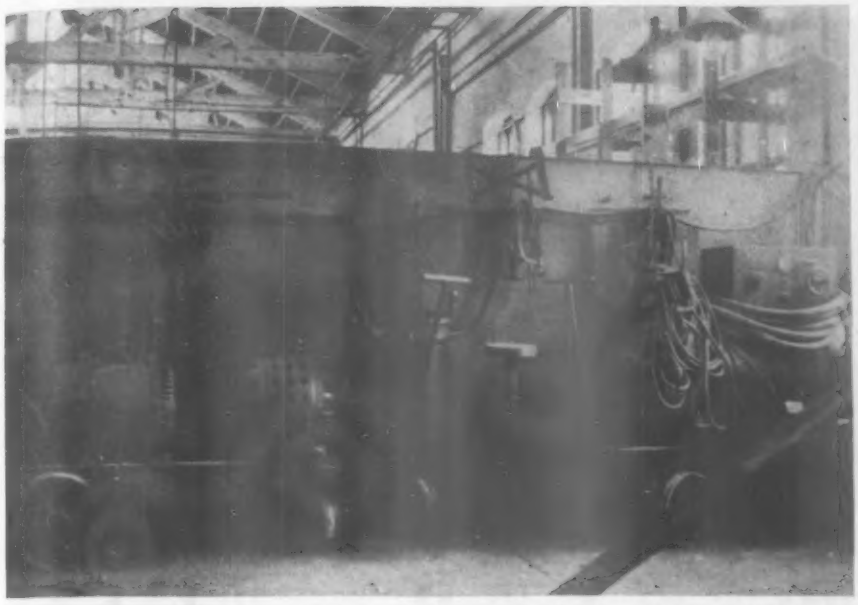


Fig. 2—The arc-welding shop is shielded by sheet-metal walls. The original welder is shown at left, the second make purchased at the right

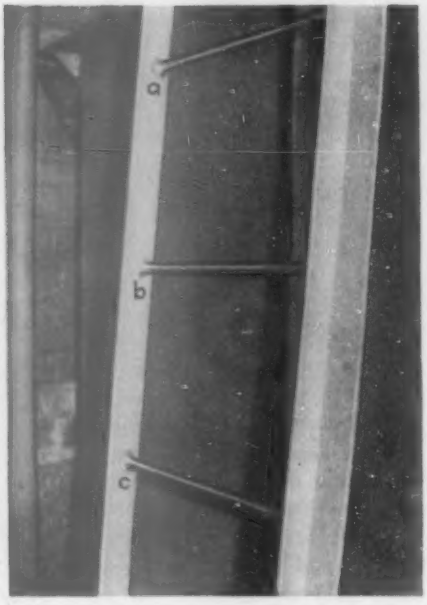


Fig. 3—This steel ladder was fabricated by arc welding the rungs

matter how troublesome the job or how ugly the finished product—the welds were made by one of the blacksmiths, not by their weldor-helper.

But when the head blacksmith shook his head over a job, and the smithy at the second forge spread his hands out in helplessness, the fusion weldor was then given a chance to see what he could do. Because of lack of practice, he, too, often doubted his own ability. If at all possible, he usually brazed the material, especially if it were cast iron.

It was then common knowledge that cast iron was hard to weld with a torch. Nevertheless, it was impossible to weld this metal on a forge, and fusion welding was the only hope of salvaging many a machine part. If a broken cast-iron piece was worth the cost of the oxygen and acetylene required, its welding was usually attempted. Yet every mechanic was skeptical of the quality of a cast-iron weld. Frequently, the blacksmith made braces (just in case he weld didn't hold) for welded cast-iron gears, pillow blocks, etc.

Good weldors among the prisoners were rare, and confidence in the new welding technique developed slowly. Because administration policy classified them as an unjustified expense, oxygen and acetylene were not available in sufficient quantities to train new weldors as fast as the old one vanished from the scene. Welding as an institution maintenance method lagged five to ten years behind national industrial procedure.

Hose Line Disaster

In those early days welding was regarded as dangerous simply because the necessary materials were held in steel pressure vessels. Trouble arose in other ways. One cold winter night an exposed section of wrought-iron water pipe froze and burst in a location which required the whole of the institution's water system to be shut off. The oxy-acetylene welding outfit was called upon to meet the emergency, but, unluckily, the outfit had to remain in the cold for an hour before the pipefitters were ready for the weld. When the weldor opened the valves, no pressure would build up in the oxygen hose. Moisture in the oxygen (far more common in those days than at present) had frozen in the valve orifice. This incident did not increase the popularity of welding in institution maintenance.

In 1924 the institution began to expand. A new laundry was erected in 1927, but with little use of welding. In 1929, however, the power plant was remodeled. Two new water tube boilers were installed to supplant two smaller ones of the fire tube type. On this job oxy-acetylene welding came into its own. The welding of steam pipes was approved, and the cutting torch was called upon to reduce the old boilers to pieces small enough to handle.

Before attempting to cut the old boilers, all parts were hammered thoroughly to remove the boiler scale from one side and the rust from the other. This prevented splashing of the oxidizing metal, saved oxygen and acetylene and kept the cutting tip cooler. If the tip became hot enough for the flame to sputter, it was dipped into a can of cold water kept available for that purpose.

Between 1929 and 1938 almost every building in the institution was remodeled or replaced. Two new cell houses were built and an old one modernized. An addition was built to the hospital, and the institution's water plant enlarged. A new cold storage, a new ice plant and a new chapel building were erected, some by contract, others directly by the State. In all of these new buildings welding was extensively used.

Cart for Gas Equipment

A handy rubber-tired cart (Fig. 1) is now used for oxy-acetylene welding equipment. The eye in the cart's tongue is merely coupled behind a delivery truck for quick transit to any outlying part of the institution. The letters on the picture indicate the location of the tool box (B), hose reel (H), rod quiver (Q), latch (L) and crank-handled clamps (C). The latch permits the lower half of the cart to spring upright to facilitate the changing of oxygen and acetylene cylinders. The

clamps hold the cylinders rigidly to the cart bed.

The first motor-generator arc-welding set was acquired on transfer from another institution late in 1930. A different make was purchased the following spring, and one of the building contractors brought in a third. The two original d-c welders are shown in Fig. 2. Both of these sets have seen strenuous service. From June, 1931, to June, 1932, and again from March through September, 1933, these welding machines ran 10 to 24 hours daily, both in the erection of new buildings and in maintaining the old. Another arc welder is now being ordered.

Long before the outbreak of World War II, both arc and oxy-acetylene welding had become indispensable and were used successfully for such jobs as building up dust mill hammers, cutting out boiler tubes and the welding of aluminum-cooking utensils. Cast-iron jobs also ceased to be a bugbear to the weldor.

Steam Piping Repaired

The real value of welding in institution maintenance is brought out by an emergency that occurred during the first year of the war. A large pipe line carrying low-pressure steam through a long underground tunnel corroded at several places where it touched concrete supports. New pipe could not be obtained through priority regulations —even if it could, the maintenance department would have faced the major task of assembling it in the underground duct and removing the old pipe. It was vital, however, to keep the line in service.

The steam was turned off to allow weldors and pipefitters to go into the duct. They cut the pipe into suitable lengths to turn with chain tongs and rotated each section 180 degrees. The lengths were then rewelded and the corroded spots also filled by welding. While this was an emergency measure, the pipe is still in such good shape that no plans have yet been made to replace it.

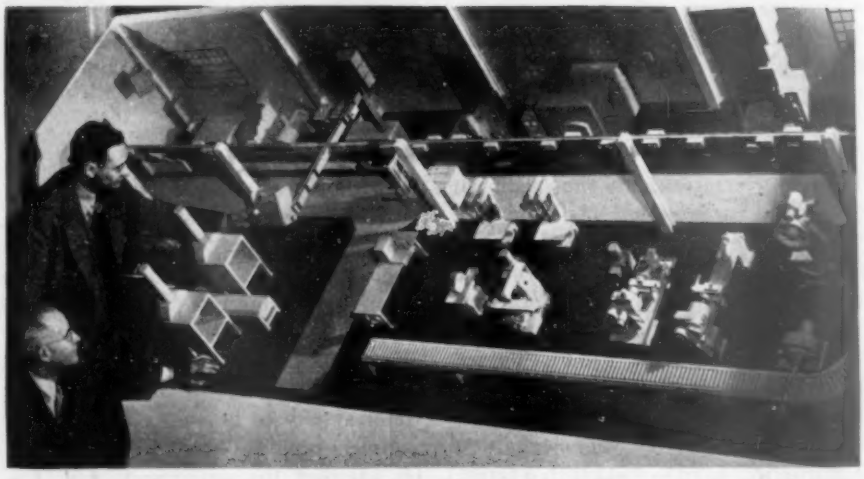
Jobs Done Better by Welding

Another emergency job on which welding proved of value during the war was in the salvage of chains by building up the worn places on the links.

Typical of jobs which can be better done by welding than by other means is the 20-ft ladder with arc-welded rungs shown in Fig. 3. In prewelding days, the rungs would have been turned at the ends, placed in holes drilled in the angle irons and then riveted. The angles would have been weakened by the holes, naturally, and heavier angles would have been required. Welding the rungs at points *a, b, c,* etc. made a stronger, lighter, neater and safer ladder.

Fig. 4 depicts still another maintenance job which could be done properly only by welding. This picture is a view of the chute of the institution's ice plant. When three of the four original guides in the chute were battered and broken by the hammering of thousands of bars of ice, pieces of automobile springs were used to supplant them. An original guide is at A; new guides at B, C and D. As shown, the springs were neatly welded to the sheet-metal lining of the chute. This lining, by the way, is only 14-gauge steel and is backed by a brick wall. Bolting or riveting of the guides would have been out of the question, even if the bolt or rivet heads could have been countersunk to permit the bars of ice to clear. Welding saved the day.

"Productive Power" Exhibit



J. L. Wagoner and R. W. Mallick, Westinghouse, view the factory model used to demonstrate advantages of adequate wiring, power-factor correction, etc.

BELIEVING that manufacturers will in the future be extremely dependent upon all types of electrical devices in order to meet the challenge of growth and survival, the Westinghouse Electric Corporation's industrial department has prepared an elaborate traveling exhibit to educate them in the newest and best methods. "Productive Power," as the exhibit is known, is soon to go on a year's tour of most of the cities in the United States having concentration of industrial activity.

Productive Power demonstrates seven applications for electric power in industry. First and most potent need, thinks Westinghouse, is for adequate wiring. A scale model factory layout is used to demonstrate the advantages of better wiring, power-factor correction and circuit-breaker protection.

The second application is resistance welding. The exhibit contains a modern, electronically controlled resistance welder, and audience volunteers who are inexperienced in factory operation will be called upon to operate it. A tensile tester is also carried to demonstrate the strength of the resulting welds in steel sheeting.

The remaining five applications are lighting, electric furnace brazing, infrared drying, r-f heating, air handling and conditioning. The induction-heating part of the program will be primarily a laboratory session.

Fig. 1—The prototype Mulberry pierhead was constructed at Old Kilpatrick shipyard on the Clyde river

Fig. 2—An earlier construction stage. Shell plates were butt welded on the prototype but later lap welded

Big Jobs for British Welding

BY E. DACRE LACY

IN THE early months of the recent world war, the welding industry, in conjunction with British engineering as a whole, was mobilized to prosecute the struggle to a successful conclusion. And welding contributed very effectively towards final victory.

About three years were spent by Great Britain, the United States and the other allies in preparing designs for the fabrication of a great amount of equipment required for the invasion of Europe. Most of this was welded because welding offered the quickest means of production.

The pierheads of the Mulberry floating harbors, the enormous drums for Operation Pluto were needed to make invasion possible. Neither project could have been accomplished without welding.

Some of the Big Jobs

Welding was used for the construction of the floating Mulberry harbor pierheads; one welding firm alone employed nearly 200 weldors on this work. The six giant drums known as *H. M. S. Conuns* (built in connection with the Pluto scheme of underwater pipe lines) were arc welded. Welding was also utilized in fabricating over 450,000 panels for Bailey bridges. Extensively used by the Army in a number of theaters of war, this lightweight sectional bridge is easily transportable and can be erected quickly, using man power only, to carry heavy tanks. Finally, welding played a large part in the construction of warships of all descriptions, in the building of landing craft and in the manufacture of armored fighting vehicles, guns and small arms.

Mulberry Pierheads

The story of "The Harbor called Mulberry" has captured the imagination of the civilized world. For Mulberry, as Ernest Bevin has pointed out, prevented 150,000 casualties. It also enabled the allied armies to achieve a firm foothold in France and fight their way to the Rhine and victory.

The construction of the prototype pierhead, designed by Lobnitz, Ltd., was carried out by Alexander Findlay & Co., Ltd., at its Old Kilpatrick shipyard on the Clyde river. On completion, it was tested out along the Solway, and because of the successful results obtained the decision was reached to build the other 22 pierheads, their bridging equipment and the breakwater.

The responsibility for the production of these vessels within the time limit was entrusted to Alexander Findlay & Co., Ltd., in view of the successful completion of "Prototype 2," but the shipyard at Old Kilpatrick was already fully occupied on Admiralty work of an equally urgent nature. Since all other shipyards were in the same position, the first problem was to find a site on which to construct the pierheads. These were ultimately found at Leith, on ground being developed as an extension to Leith Docks at Cairnryan, a military depot occupied by Royal Engineers, and at Conway in North Wales.

Thirteen pierheads were built at Leith, four at Cairnryan and five at Conway. Thus 18 of the total of 23 pierheads, including the prototype, were built in Scotland, and site welding was carried out on a total of 15.

The prototype differed from the production pierheads in that it was built piecemeal. The hull was entirely butt welded, but the transverse and longitudinal bulkheads and the internal bracing were delivered to the site ready for installation. Figs. 1 and 2 show the prototype under construction.

Prefabricated Construction

In the light of the experience gained on the prototype, it was decided to alter the design to permit a greater measure of prefabrication. These alterations were in detail only, and in principle the production pierheads remained similar to the prototype.

The extra prefabrication was mainly on the spud wells, the superstructure including the cross girder, and the deck and bottom plates. The latter were delivered to the site with the longitudinal channels welded in place. The deck treads were also shop welded.

The reasons for prefabrication were:

1. The parts could be turned by crane so that welding was quicker by virtue of the use of larger electrodes in the downhand position.

2. More of the work could be done under cover, unaffected by weather conditions.

3. Most of the work being downhand, welders of less skill could be used.

4. The parts to be fabricated were contracted out to a large number of firms having the necessary facilities.

5. Work could be continuous even during blackout periods, a point which had caused trouble with A.R.P. and police services during the construction of "Prototype 2."

Lap Joints Used Extensively

Though the prototype had been butt welded, lap joints were favored on the other pierheads for the following reasons:

1. To bring prefabricated parts into position with closely butting edges called for a degree of accuracy not likely to be obtained throughout the job. Laps, however, could very either way and still give a close enough fit-up for welding.

2. In the prototype, all of the skin plates had to be beveled to give a double-vee preparation. This machining was in itself a task of considerable magnitude. Bearing in mind that the pierheads were 200 ft long, 60 ft wide, and 10 ft deep at the sides, it is doubtful if the necessary machining capacity was available.

In the production pierheads, some of the plates were from universal mills (having rolled edges), and those that required planing could be batch planed.

3. It was necessary to employ weldors of the trainee type. Experience had shown that these men, while capable of making quite good lap welds in the downhand position, generally require some further tuition before they are able to do either positional or butt welding satisfactorily.

4. By lapping instead of butting, each compartment became a separate unit, allowing weldors to start and carry on welding whenever the steel was erected in place. In the butt-welded prototype, a certain procedure and sequence of welding had to be carried out, and the speed of erection was governed by the speed of welding.

Parts and Materials

Many firms took part in the prefabrication. Longitudinal and transverse bulkheads, bracing, sloping stays, spud casings, cross girders, deck and bottom plates were contributed from many sources. Some of these parts were welded and some riveted, according to the facilities in the shops concerned. Riveted and welded parts fitted in equally well. The Lanarkshire Welding Co., Ltd., carried out the making of spud casing parts in addition to much site work, and it is creditable to all concerned to state that there was no major hold-up at any time for want of materials. Coated mild-steel electrodes were used for all welding.

At the site, the supply cable was arranged to run along the face of the four berths and was tapped to provide for a possible 40 to 50 weldors at each berth. A-c transformer weldors accommodating six, three and single operators were installed so as to allow for the moving of operators from one berth to another. As the berths were very close together, the men could be moved from one to another by simply extending their cables, which were fitted with detachable connectors to simplify this procedure.

Where there were numbers of weldors using small electrodes on positional work, three-operator and six-operator transformers were converted to six and twelve operators, respectively.

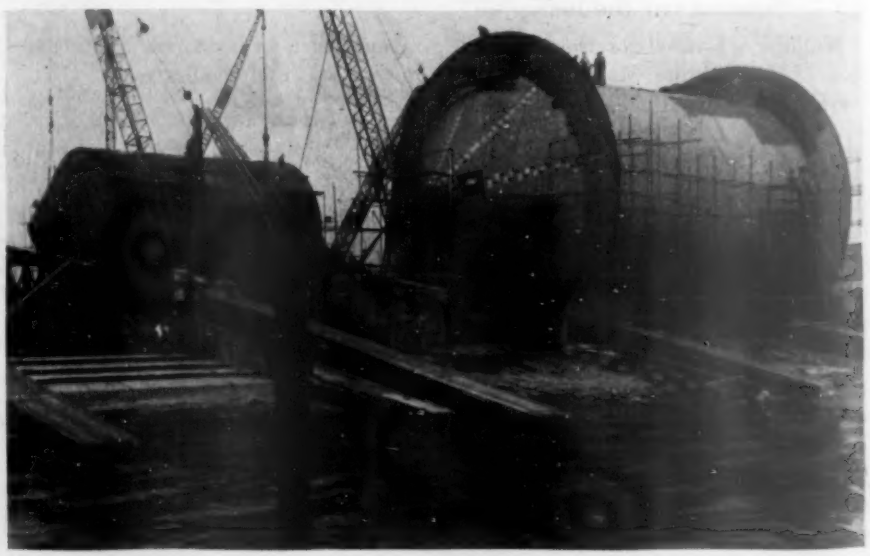
As the tides only served for launching on three or four days a month, the cable was extended to Newhaven Quay, about 300 yards distant, and a welding plant was installed there for fitting-out operations. This, of course, obviated any necessity for holding a pierhead on the berth beyond the prearranged time and so interfering with the laying of the keel of the following vessel.

A New Shipyard

In a little more than three months from the time the first steel-work arrived at Leith, a complete shipyard had come into being. Power, water, drainage and railway had been laid. Offices, workshops and stores had been built. Cranes were erected. Berths and launching ways were ready for the vessels. This in itself was a remarkable performance and contributed in no small measure to the success of the whole project.

The first pierhead was launched from Leith on Jan. 26, 1944; the second was launched in February and the third March 11. On the last date, the

Fig. 3—Two Conuns for Operation Pluto (pipe lines under the ocean) on the assembly base. The one in the foreground is nearly ready for launching



Minister of Supply asked for a total of nine pierheads from Leith by the end of April, and on Sunday, April 30, the ninth pierhead was delivered. The remaining four were completed within the required time, and the yard then went over to the construction of 16 intermediate pontoons, another part of the same project.

Welding Details

In the prototype, the spud well plating above and below deck was welded piecemeal; in the later pierheads it was prefabricated. The same applies to the upper cross girders. The bottom plating and the deck plating were supplied with the channels and deck treads welded on, and wherever possible the angles, etc., forming means of attachment were shop welded to the plates.

The transverse bulkheads were shop welded in two pieces, except for end bulkheads where the part was incorporated in the redesigned spud wells. The welded girder formed the seating for the spud winches. It was intended that holding-down bolt holes should be drilled on the site, but the holes were ultimately templated and shop drilled, which proved satisfactory. In welding large areas such as transverse bulkheads, special allowance had to be made for contraction. Longitudinal bulkheads also had a tendency to buckle and had to be watched carefully. Transverse girders were riveted shop construction with bolted side connections to longitudinal bulkheads.

The additional fabrication and the alterations in design resulted in a reduction of the site welding to about 55% of the prototype, reckoned in man hours.

By suspending operations on Bailey bridges, about 70 weldors were freed to go to the site at the start of the work there. This number was later augmented to about 150, mainly by the good services of the Ministry of Supply and the Ministry of Labor.

To sum up, in nine months from the time the job was proposed, a complete shipyard had been established and thirteen welded vessels, each over 1,000 tons, had been built, launched, fitted out and delivered.

Operation Pluto*

"They wound a pipe line round a drum like a cotton on a reel; they towed it on a large bobbin, laid it under the Channel and across the Continent; they then pumped a million gallons of petrol to our armies every day." Thus wrote Basil Cardew of the *Daily Express*.

Each bobbin, and there were six in all, was known as *H. M. S. Conun;* they were fabricated and constructed by Orthostyle Limited, Scunthorpe Lincs.

The prefix H. M. S. is always used in connection with shore stations, but in the case of the Conun it can be said that it really referred to a ship, not a streamlined job or one easy to handle, but nevertheless a true ship with bulkheads and watertight compartments. Each of these unique vessels was designed to carry a heavy cargo of pipe some 80 miles in continuous length.

The drums had to be designed to carry a water-borne load of 1,500 tons, and it was necessary that they should be as light as possible to permit carrying of the maximum load of steel pipe; it was also essential for the drums to be perfectly watertight.

In view of the preceding considerations and the fact that a time limit had been set for the completion of the work, welded construction was decided upon.

Mass-Production Methods

To save time in preparation of material and to speed up site welding and insure watertight joints, it was decided to use deep-penetration welding wherever possible. Orthodox construction methods were discarded in favor of prefabricated sections weighing up to 15 tons for erection on the site.

Concrete assembly floors were laid at the site, and pits or trenches were dug for electric distribution cables. Suitable handling equipment enabled work to progress on four drums in various stages at the same time.

To permit downhand welding and facilitate erection, especially designed cradles were built with roller tracks conforming to the contour of the drum. This equipment made it possible to rotate the drum in either direction by means of a monkey winch, permitting a welding procedure involving the use of large electrodes.

There was no edge preparation on the plates making up the shell of the drum. The $\frac{3}{8}$-in. plates were set up with a $\frac{1}{8}$-in. gap on the roller tracks and tack welded. The sealing run was made first, using $\frac{5}{32}$-in. electrodes; this served as a foundation for the deep-penetrating weld on the reverse side, which was made with $\frac{5}{16}$-in. electrodes at approximately 480 amp.

Fig. 3 shows two Conuns on the assembly base. One is nearly ready for launching; the other (in the background) is in the course of erection.

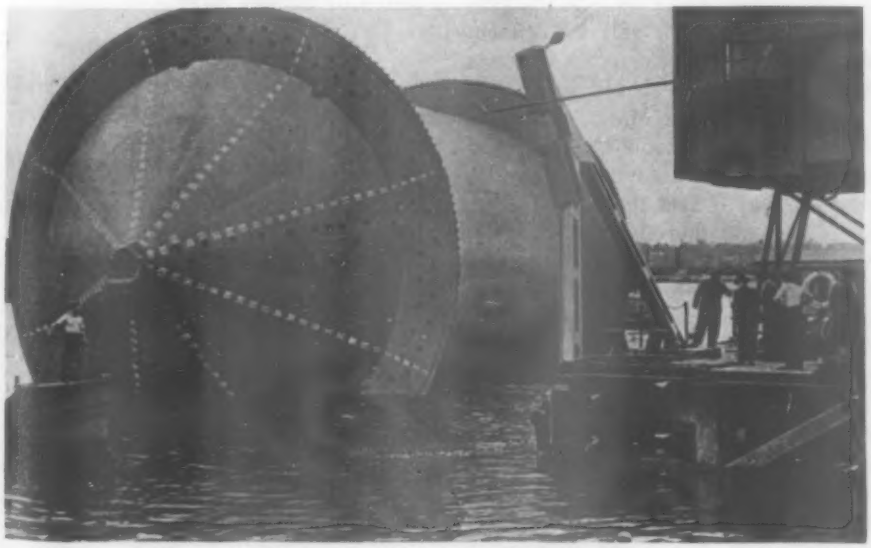
Welding the Ends

The conical ends were made from $\frac{3}{8}$-in. plate prepared in the orthodox way with 60-deg vees. These plates were welded with two runs of $\frac{5}{16}$-in. electrodes, and a sealing run of $\frac{5}{32}$-in.

(Please turn to page 68)

*For additional details see, "Pipe Lines for Pluto," page 49, The Welding Engineer, July, 1945.

Fig. 4—A Conun ready to be wound with its steel pipe. The enormous size of this floating drum can be gauged from the sailor standing alongside



★ TRAINING

PARKS Teaches Air St

Manipulative skill in welding and a thorough understanding of its basic principles are required of every prospective airman who comes to study at the first Federal-approved aviation school in the U. S.

Oxy-acetylene welding at Parks Air College, East St. Louis. Students are required to learn to weld as part of their courses in aviation maintenance engineering and aeronautical engineering. Arc welding is also taught at Parks

PARKS Air College, East St. Louis, Ill., considers welding so important that it is a requisite of every course. Every student is required to take 90 to 150 hours of instruction in welding as part of the 2½-year courses.

Students in the aviation maintenance engineering course have 30 classroom and 120 shop hours of instruction. Men in the aeronautical engineering and aviation operations engineering schools have 30 classroom and 60 shop hours of instruction.

Stress Gas Welding

Parks has the No. 1 certificate in the United States for Federal approval as an aviation school and is No. 14 among CAA approved aviation repair bases. These low numbers indicate the school's long history in the field.

Most of the welding instruction centers about the oxy-acetylene process since this is the most widely used for aircraft maintenance. Equipment includes 25 complete sets for students to use in gas-welding operations and 12 to 18 cylinders, including those supplying three portable welding outfits.

Parks stresses aircraft welding because it is necessary for a student to master aircraft gas welding in order to get this CAA aircraft and engine mechanic's license. Securing the license is one of the requirements before a student receives his Bachelor of Science degree and diploma.

The school finds that it can tell from watching a student learn to weld whether or not he will make a good all-around aviation engineering man. This is because welding requires coördination of a man's hands and is one of the highest skills a craftsman can master. It is true that a lot of so-called "weldors" were employed in the aircraft industry during the war, but these were essentially piecework personnel who knew only one minor operation. They simply aren't in the same class with experienced, all-around weldors.

Why Welding Is Taught

After graduation, only the students of the aviation maintenance engineering course will probably be directly connected with welding operations. Nevertheless, the school believes that every one of its graduates, regardless of the aviation field they are to enter, should have a thorough knowledge of the craft. It is the Parks theory that a graduate of the operations engineering course, for instance, must be able to understand the problems of maintenance men when he becomes a fixed based operator or operates his own airport; such understanding is impossible unless he knows welding.

We also feel that in developing aeronautical engineers we should teach them the actual use of welding and welded sections in the building of aircraft. Every aircraft has some parts that are welded, and in many the welded structure is the backbone of the airplane—an additional reason for instruction in the subject.

Welding teaches a student planning as well as physical coördination, Parks believes. That is because a welding job once started must be either completed or thrown away.

All Positions, All Joints

In the gas welding of steel, Parks teaches the following types: fillet, cluster, butt and lap welds. The school is not satisfied to develop and train men who can weld at benches but also requires that they be able to do overhead and vertical welding. A student may be steady when he is given the support of a bench, but actual welding conditions in airplane maintenance shops and airplane plants require steadiness on his feet and at difficult angles.

Fillet, butt and lap welds also are taught in aluminum welding, and students are instructed in brazing, silver

Students to Weld

BY J. THOMAS HARRINGTON
Instructor in Welding, Parks Air College

This student is making a tubular steel cluster joint. Students learn to weld from standing positions and from difficult angles, approximating the conditions they will encounter in the aircraft industry

soldering and low-temperature welding. The school keeps abreast of the latest developments in welding through the reading of trade magazines and contacts with the field of aviation. Suggestions, recommendations and ideas are being constantly sent back to the school by its graduates, who hold responsible positions in aviation all over the world.

It is the Parks policy to combine theory and practice and to teach types of welding which, though not widely used in the aircraft industry now, may be of future importance. This plan gives complete coverage of the field and still retains emphasis on the factors of immediate practical importance.

Arc welding of aluminum and steel is taught, and students practice on a 200-amp welder. Resistance welding is taught in theory only.

Here is a summary of the course, including the lectures given in classrooms to balance the shop work.

Outline of Course

1. History of welding.
2. Welding equipment (all types).
3. Set-up and adjustment of equipment.
4. Gases used in welding. Their manufacture and development.
5. Safety precautions in welding. The storage and handling of gases. Cylinder construction. Importance of wearing welding goggles.
6. All types of welded joints, their designs, rated strengths, etc.
7. Civil Aeronautics Administration regulations on welded joints including approved splices and repairs. For this lecture the CAA Manual 18, regarded as the Bible of aviation maintenance, is used extensively.
8. Fuselage alignment after welding.
9. Aluminum and steel tube bending.
10. Brazing.
11. Hard soldering.
12. Welding of stainless steel.
13. Welding of nickel-base alloys.
14. Welding aluminum and its alloys.
15. Inspection and testing of welds.
16. Heat treatment, tempering and case hardening.

Students are given the opportunity in their final weeks of instruction to see the practical application of all they have learned. They do actual welding work on airplane fuselages, landing gear and engine mounts.

Parks feels that the best proof of the value of its welding course is furnished by its ex-students, many of whom hold excellent positions in maintenance engineering and other fields of aviation. It is interesting to note that the students actually express a liking for the course. And from a college student that is high praise, indeed.

Welding a tubular steel fuselage. Instructors stress the importance of wearing safety goggles at all times

Parks students work on practical applications. This man is welding airplane engine exhaust collector rings

★ RESEARCH

Effect of Elongation o

Fig. 1 — All-weld-metal specimens. These fractures are typical of the results of ordinary tensile tests

Do elongation tests of all-weld-metal specimens bear any relation to the ductility of an unmachined weld? This author thinks not.

QUALITY is a relative measure. From the standpoint of welding, any weld which satisfactorily performs the function for which it was made should be considered a high-quality weld for that application regardless of its appearance, tensile strength or ductility. Therefore, the use for which a weld is intended must be known before it can be determined whether or not it is of high quality.

The Question of Ductility

Quality is frequently interpreted to mean the physical properties of the weld metal; i.e., yield strength, tensile strength and elongation. Yield and tensile strength are seldom mentioned in connection with the welding of mild steels because it is generally accepted that the weld is stronger than the plate. However, the question of ductility of the weld metal is frequently discussed.

Ductility is normally determined by measuring the elongation of an all-weld-metal specimen. The elongation figure so obtained is misleading because there is no relation between the elongation obtained in a machined weld-metal specimen and that which would be obtained in a weld on a particular product.

Most welds are used in the "as-welded" condition and the surface of the weld is not machined. When a weld in the "as-welded" condition is tested for elongation, the value obtained is controlled greatly by the bead shape and smoothness and only slightly by ductility of the weld metal. It is, therefore, impractical to decide to use an electrode which has an elongation of 17% rather than one which has an elongation of 22 or 25% when the figures are based on tests of all-weld-metal specimens. This point is substantiated in the accompanying pictures of various test specimens.

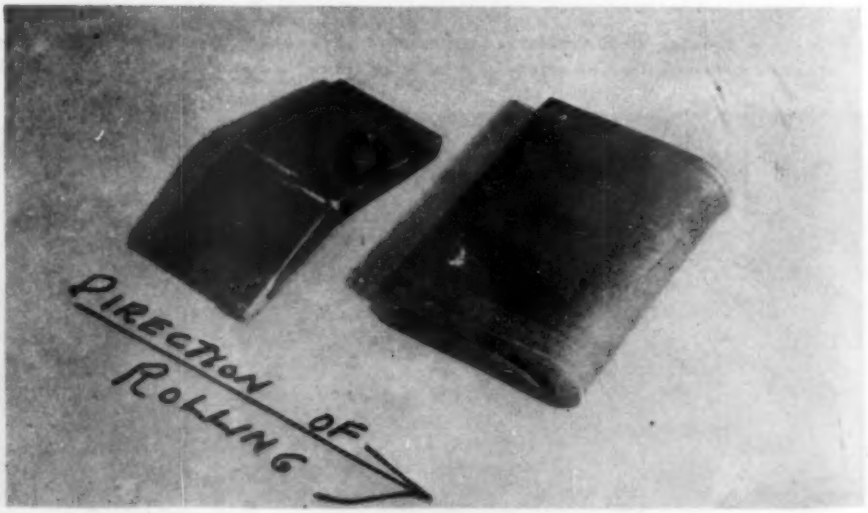
Fig. 1 shows two all-weld-metal tensile specimens. The one shown below was welded with AWS E-6010 and the specimen above with AWS E-6012 electrodes. The specimen welded with the E-6010 has an elongation of 28%, and the fracture is of the cup-and-cone type. The specimen welded with the E-6012 type electrode has 18% elongation and did not have the cup-and-cone type of fracture. These two fractures are typical of those resulting when E-6010 and E-6012 electrodes are tested in accordance with the American Welding Society filler metal specifications.

Weld-Bend Comparisons

Fig. 2 shows two butt welds that were made on ½-in. plates cut from the same bar of steel. The weld at top in this picture was made with an E-6010 electrode and the specimen below with an E-6012. After welding, both plates were bent in an attempt to make the unmachined weld beads fail.

The weld made with the E-6010 electrode failed after bending 100 deg. The weld made with the E-6012 elec-

Fig. 4—Ship plate specimens of ⅜-in. thickness. The specimen at the left failed after a 25-deg bend, but the one on the right bent double without failure. The reason for the difference is given in the text



on Weld Quality

BY L. K. STRINGHAM

Engineer in Charge of Welding Applications, The Lincoln Electric Co., Cleveland,

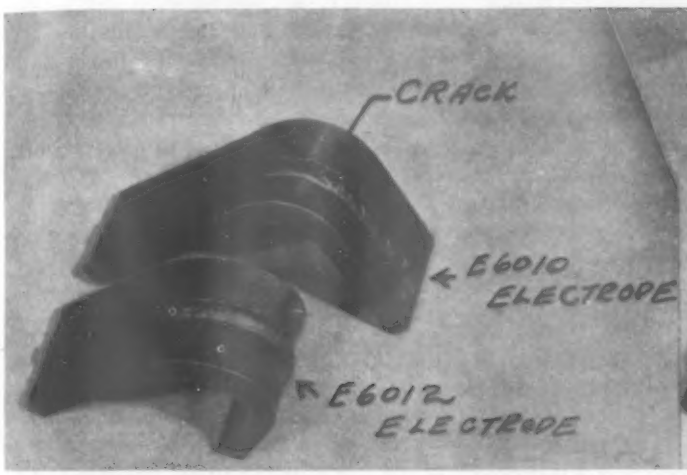


Fig. 2—Butt welds in ½-in. plate. The one welded with an E-6010 electrode failed after a 100-deg bend; the E-6012 weld remained intact after being bent 160 deg

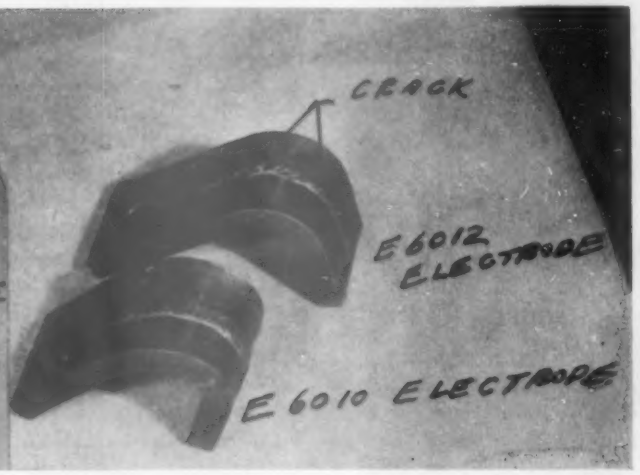


Fig. 3—These tests showed the reverse of Fig. 2. The weld made with the E-6012 electrode failed after a 110-deg bend. The E-6010 weld did not fail after 160 deg

trode showed no failure after a 160-deg bend.

Fig. 3 is similar to Fig. 2 except that the weld made with the E-6012 electrode (above) failed after 110-deg bend, and the weld made with the E-6010 electrode (below) showed no failure after bending 160 deg. This is very nearly the reverse of the results given by the tests pictured in Fig. 2.

Before interpreting the above conundrum, it may be well to examine Fig. 4, a photograph of two adjacent pieces of a ⅜-in. plate. One of these pieces bent double with no failure and the other failed across the entire surface after a bend of only 25 degrees. This same plate when tested in accordance with ASTM specifications A131-39 (Structural Steel for Ships) had 26% elongation in 8 inches and a tensile strength of 65,000 psi.

The Riddles Explained

To sum up all these results, one of each of the weld specimens was made with an E-6010 and one with an E-6012 electrode; one plate sample was capable of bending without failure much more than the similar sample. Now if the surfaces of these welds are examined, one will see that the E-6012 weld in Fig. 2 has a smooth, uniform ripple, the E-6010 weld in the same figure a coarser ripple. In Fig. 3, the E-6012 weld has the coarser ripple and the E-6010 weld the finer ripple. This indicates that the ability of the weld to elongate depends more on the surface condition of the bead than upon the type of electrode.

The explanation of Fig. 4 is that the failed sample at left was bent parallel and the other was bent at right angles to the direction of rolling. Failure was caused by fine shallow seams in the plate bent parallel to the direction of rolling. A certain amount of steel has these fine seam defects, but such steel has been successfully used for years without any apparent trouble even though it is capable of very little elongation. If the steel itself needs very little elongation to perform satisfactorily, obviously the weld metal needs only a little. That makes any question as to whether an all-weld-metal specimen should have 17 or 22% elongation a rather poor basis for controversy. The question is irrelevant to safety considerations since 17% is more elongation than can normally be used and also because the elongation figure obtained from an all-weld-metal tensile test is no criterion, relative or absolute, of the ability of a weld to elongate.

False Impressions Created

To continue a step further, the quality of a weld made with an E-6012 or E-6013 electrode is not and should not be considered lower than that of one made with an E-6010 or E-6011 electrode on the basis of common but unappropriate test methods. As before explained, these tests create false impressions.

Since the differences in elongation in the 60,000-psi type of electrodes cannot be used intelligently to help users to select the proper electrode, the elongation requirements should be the same for electrodes in the same tensile-strength class.

All-Welded SPHEROIDAL

BY JOHN H. GIROUX

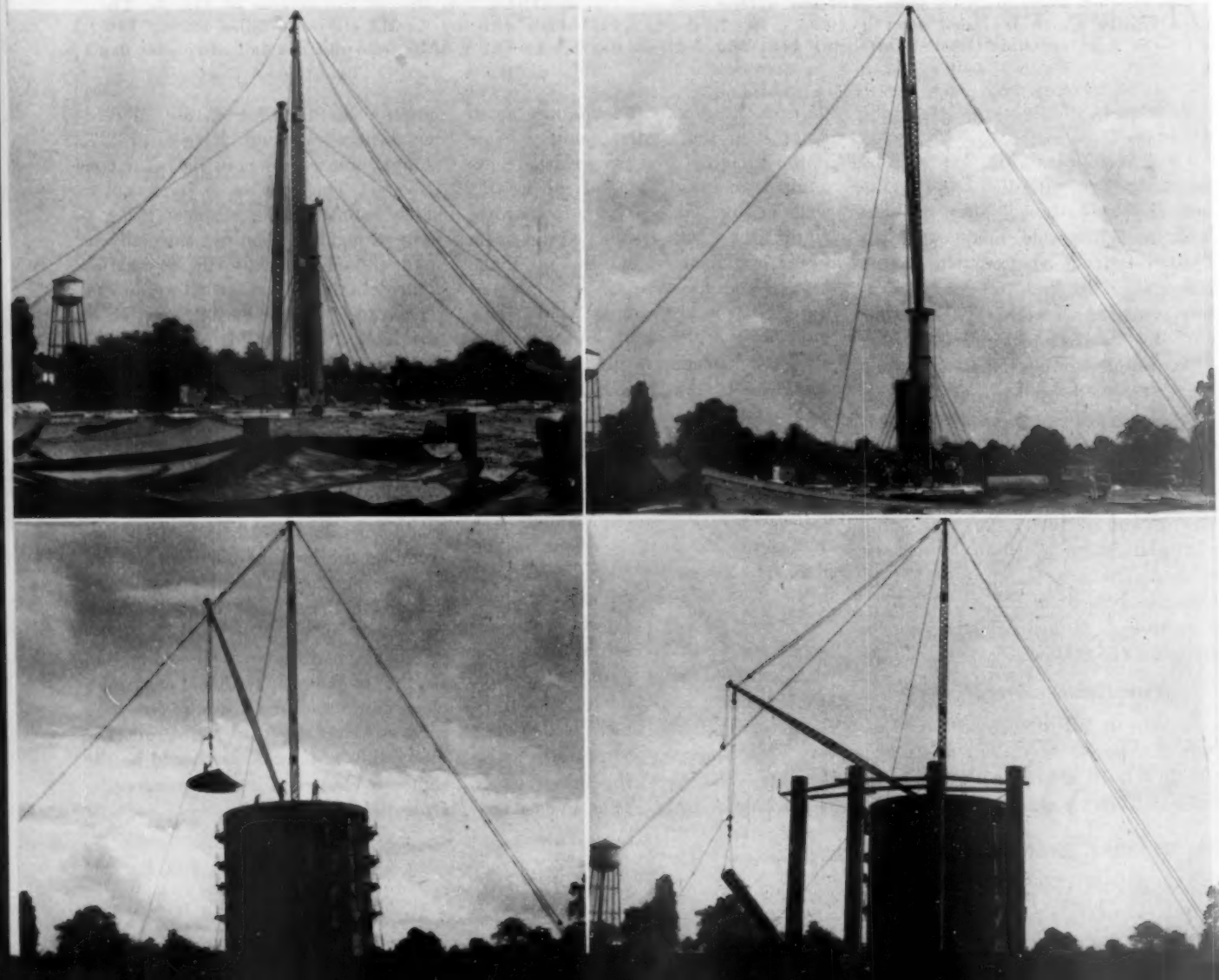
IN 1941 water division officials of the District of Columbia recommended the installation of a 2,000,000-gallon water tank to provide a reasonable storage reserve, independent of direct pumping, to supply increasing consumption in the section adjacent to the southeastern boundary of the nation's capital. Came Pearl Harbor and wartime complications such as material shortages and the difficulty of obtaining a proper site. For these reasons, the project remained dormant until August, 1944, when construction companies were asked to submit a design for a tank based on the following specifications: "Overflow to be at elevation 382. Elevation of ground at site 295-300. Permissible range in head 35 ft."

Tank Features New Design

The tank was to be erected in the Anacostia section of Washington, near the intersection of Alabama and Boulevard Avenues, which is an almost exclusively residential region of good property values. Hence the esthetic appeal of the finished structure warranted particular attention.

Of the plans submitted, that of the Chicago Bridge & Iron Company was chosen. All applicable details of this unconventional structure were in accordance with American Water Works Association specification 7H.1-1943. The design called for an all-welded spheroidal tank (Fig. 1) 106 ft in diameter to be supported on sixteen outer columns 4 ft in diameter and a fluted central column 40 ft in diameter. The 16 supporting columns are 52 ft 6 in. high and define a 96-ft. circle. The fluted column, 47 ft high, was fabricated from plates approximately 8 ft

Fig. 2 (upper, left)—Raising of the 5-ft-diameter riser pipe was the first step in construction. The 68-ft boom of the guy derrick was used for this task. Fig. 3 (upper, right)—First section of the fluted column being put into place. Lugs used for the fitting-up process may be seen on the sides of the plate. Fig. 4 (bottom, left)—Hoisting the bottom section of the spheroidal tank. This was later welded to the plates attached to the box girders and to the narrow ring at the top of the fluted column. Fig. 5 (bottom, right)—The sixteen outside columns were erected in one piece, reducing field work. Each of these outer columns is 4 ft in diameter and was delivered to the job in one piece



WATER TANK

It is not often that the combination of esthetic appeal, new design and low maintenance can be acquired at low cost on a water tank. It was accomplished, however, on the 2,000,000 gallon welded tank erected by the Chicago Bridge & Iron Company for the District of Columbia.

Fig. 1—A fluted central column and a spheroidal tank join for esthetic appeal in this 2,000,000-gal welded water tank erected in the nation's capital

wide and bent to a 9-ft radius. These curved plates were joined by welding. Located inside of this central column is the 5-ft-diameter riser pipe which connects the tank to the main water distribution system. Overall height of the tank is 99 ft. The range in head is 34 ft 6 in., with the low water level 49 ft above the ground.

Construction began with the erection of the 5-ft riser pipe to its full height of 45 ft 7 in. This operation was carried out as shown in Fig. 2. The guy derrick used had a 90 ft mast and 68 ft boom. When the riser was completed it became the base of the derrick. From this added height, the comparatively short boom derrick was used to erect the remainder of the tank (Fig. 3). A dual-drum hoist using compressed air (originally built for steam operation) supplied the power for the derrick.

Fitting the Column Plates

Erection of the riser was followed by construction of the fluted central column. The formed plates, each equal in length to one-half the height of the 47-ft column, were set up individually as shown in Fig. 3. When all plates had been raised, temporary connections between plate sections were made to permit proper spacing of all sections prior to welding. This fitting-up process consisted of the use of patented lugs welded to the steel. The width of the joints could be properly adjusted by driving tapered pins through the lugs. When all the sections were thus properly aligned, the lower end of each plate was welded to a 26 by 1-¾-in. continuous base plate which had been previously connected to the concrete footing by 2½-in. bolts on an 8-ft spacing. The formed plates were now ready to be welded up to and beyond the lowest temporary connection. After this was done, the lugs were knocked off and the final weld made in that section.

The upper half of the column was next raised, utilizing the same procedure for alignment and fabrication. This was followed by assembling the narrow ring between the central column and the bottom of the spheroidal tank.

The bottom of that portion of the tank (Fig. 4), between the riser and the fluted column was erected next. These bottom plates were welded to the ring between the tank and column to complete the central unit.

The outer columns (Fig. 5) were delivered to the job in one piece, thus eliminating any ground fitting and welding. As a result, a column could be erected in a comparatively short period of time. These members were supported by 2-in. shims. The spaces occupied by the shims were filled with cement grout. All columns were made fast to the footing with two 1¾-in. bolts.

Next up for assembly were the triangular box girders (Fig. 6) used to transfer part of the overhanging load of the tank to the outer columns. Each of these triangular girders was made up of three welded plates and a short protruding cylinder that was welded to one of the outer columns.

Prefabrication facilitated the construction of the sides, bottom and roof of the tank. Two or four formed plates were welded on the ground, and this prefabricated section was then hoisted and placed as a unit (Fig. 7). Before welding, the plates were joined by the same patented fitting-up process employed to construct the fluted column. The lugs earlier described were used again, after all sections were in their final elevated position, to assure equal

spaces for welds between plates.

The same welding procedure was used on both the sections joined on the ground and those joined on the tank. The side and bottom plates were prepared by beveling a double-vee groove. A continuous weld was made from one side, and the opposite side was chipped out with a pneumatic hammer. A second continuous weld was then made to fill all of the space on the second side. The roof plates were prepared by beveling a single vee-groove and were welded from the top side against backup strips. The welds were made manually using six 400-amp d-c welders that had been mounted on skids to permit them to be moved to any part of the ground. The majority of the welds were made with AWS E-6010 electrodes varying in size from $\frac{5}{32}$ to $\frac{1}{4}$ in.

Because there is no bracing between the outer piers, the foundation design required the fluted central column to carry the entire wind load. The outer columns carry the snow load, all the weight of the upper steel, a part of the bottom steel and a portion of the water load. The balance of the water above the 5 ft-riser is carried by the center spread footings.

The foundations were designed for a soil pressure of 5,000 psf with maximum loads of 88.5 tons on the center pier and 3,806 tons on the 40 ft-diameter footing under the fluted column. A total load of 416 tons was figured for each of the sixteen outer structures. These figures were not accepted, however, until a bearing test 6 ft below the surface of the center footing had been made and showed good supporting properties. Two bearings were carried 70 ft below the surface as an added study of the soil composition.

Since the design of the fluted column was comparatively new, its ability to withstand loads was known only through mathematical calculations. To check these, a prototype of the unit was built by the Chicago Bridge & Iron Company on a scale of 1 in. to 1 ft of sheets 0.08 in. thick. Two of these scale models were tested for comparison at the University of Illinois. One was a cylindrical shell with a nominal diameter of 41 in. and 48 in. high. The other was a fluted shell of the same height with a 41 in. outside diameter. The latter shell consisted of 16 flutes, each having a radius of 10 in. Both shells were fabricated by welding them from the outside only.

The net weight of the cylindrical shell was 106 lb, equivalent to 26.37 lb per ft of length and corresponding to an area of 7.76 sq in. and a thickness of 0.058 in. This model failed at 54,000 lb, equivalent to a unit stress of 7,000 psi.

Total weight of the fluted shell of the model was 143 lb or 35.7 lb per ft of length, corresponding to an area of 10.5 sq in., and thickness of 0.075 in. The second model failed at 277,000 lb or 26,400 psi. Points of failure for the two models may be seen in Fig. 8.

Foundations for the tank were built by Leo Butler Co., Silver Springs, Md. The balance of construction and design of the tank was by the Chicago Bridge & Iron Company. Fred Moyer of this company suggested the use of the design of the fluted column.

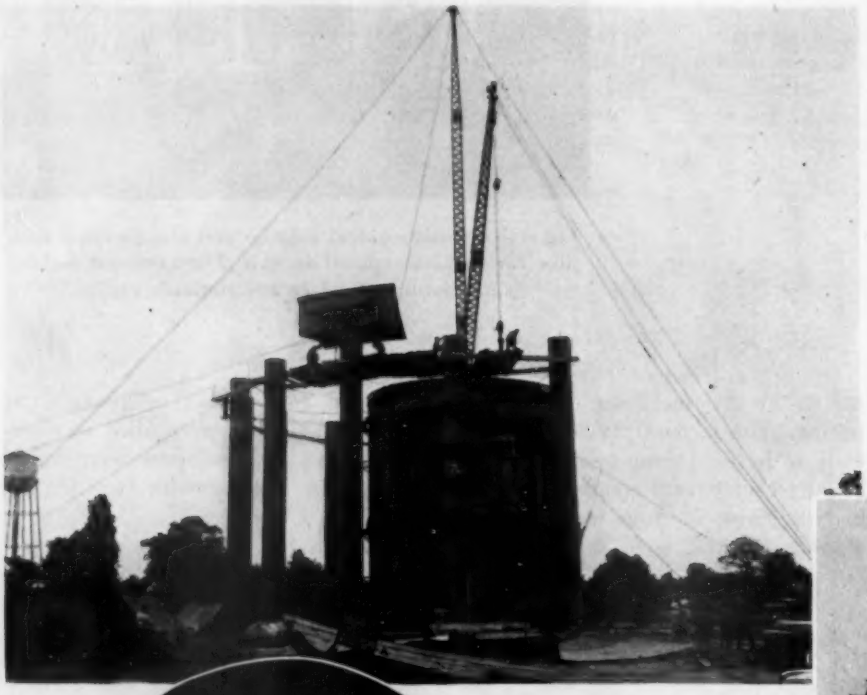


Fig. 6 (left) — Triangular shaped girders formed a ring above the outer columns. Some of the prefabricated girders appear in the left foreground. Note the pre-welded cylinder

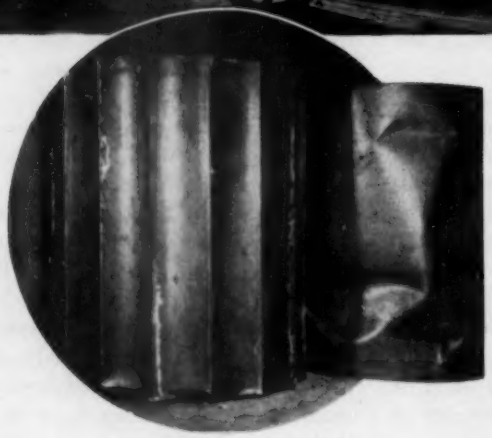


Fig. 7 (right)— Tank sections are welded on the ground and raised in prefabricated units of two or four plates

Fig. 8 (left)—Scale models built to check the strength of the fluted column design. Note the points of failure for both fluted and cylindrical models

★ RESEARCH

Portable Spot-Weld Analyzer

BY F. J. HAUNTY

Welding Technical Advisor,
Curtiss-Wright Airplane Division Plant

Above: Several cables lead from the portable analyzer to the spot welder. On the latter machine is a strain gauge to pick up force and a toroid winding to pick up current applied to the weld. Emerson Cooper, Curtiss-Wright Columbus plant, is the welding operator

Left: The spot-weld analyzer is shown here with the man who developed it, J. F. Haunty, welding technical advisor with Curtiss-Wright Corp., Columbus, O. The weld cycle shows up as a bright green curve on the oscillograph screen

Ingenious use of the cathode-ray oscillograph reproduces the current and pressure transients of a particular spot welder on the screen of the cathode-ray tube where they can be photographed for careful study.

A PORTABLE analyzer nicknamed "Herman" by its proud parents has been an important factor for the past several months in testing and perfecting aluminum spot welds at the Curtiss-Wright Columbus, O., plant. What the analyzer sees it photographs, and through photography welding can be done with slide-rule accuracy.

CHECKS WELDER PERFORMANCE

Previously, it was not possible to analyze the true performance of a welding machine. The governing factors—the current and pressure values and their time relationships—may be established by calculation and empirical methods, but if the machine does not perform as expected the purpose of the schedule is defeated. Therefore, it is highly desirable to be able to check the performance of each machine quickly and accurately.

The instrumentation built and employed by the writer is quite simple in design and construction. It is portable, very easy to operate and can be connected to a welding machine in less than five minutes. Basically, "Herman" consists of a cathode-ray oscillograph and associate circuits for reproducing the current and pressure transients of a welding machine on the screen of the cathode-ray tube. The amplitude of the current and pressure traces can be calibrated in amperes and pounds respectively. By use of a timing wave, their time relationships are readily comprehensible. It is also possible to indicate tip temperature as well. The versatility of the analyzer enables its use for various other tests.

The use of a long-persistence screen

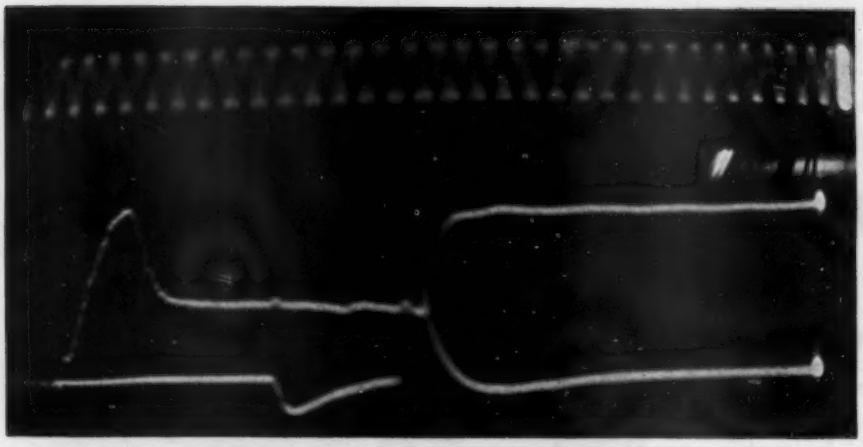


Fig. 1—A good weld cycle, in which pressure and current traces are in their proper time relationship. A uniform 30-cycle timing wave appears below

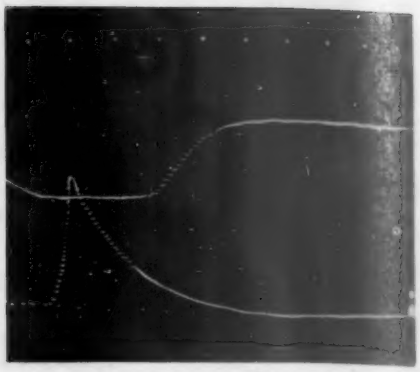


Fig. 2—In this oscillogram, a faster sweep speed than Fig. 1 is used to emphasize the relationship of the current discharge to forging force. Above are the 60-cycle timing dots

enables the observer to compare subsequent machine operations, thereby readily determining the consistency of performance. The trace remains visible on the screen for approximately 15 seconds. Therefore, several repeat welds can be made, and the performance of the machine compared for each.

Easy to Take Pictures

For recording purposes the screen of the cathode-ray tube is photographed. A camera adapter is readily slipped in place to take the exposure. It is possible to take more than one exposure on the same film by shifting the trace each time in order to prevent superimposing.

Welding machine performance characteristics are readily analyzed by the study of a photograph of the transients, after which corrections or desirable changes can be made. The accompanying oscillograms offer a good example.

Fig. 1, a good weld cycle, shows the pressure and current traces in proper time relationship, using a 30-cycle timing wave. Fig. 2 is essentially the same as Fig. 1 except that a faster sweep speed (60-cycle timing dots) is used to concentrate attention upon the relationship of the current discharge to forging force. Fig. 3 (60-cycle timing wave) shows two consecutive machine operations: *(a)* delayed forging force application and *(b)* advanced forging force application. Fig. 4 is an improper weld cycle; the pressure trace is erratic, and the short-circuiting timing contactor late. In addition, a bad rectifier tube is indicated by the a-c modulation of the current trace during charging time.

With this analyzer the writer has been able to make changes in the performance characteristics of welding machines that were not provided for (by simple control adjustment) in the design of the machine. A photographic record of the performance of each machine for each welding schedule can be kept on file for reference and comparison. This helps greatly in the event of a major change in machine controls or during general maintenance. The analyzer is used continually for spot checking the welding machines while in production. It is also used periodically in the general maintenance of all machines.

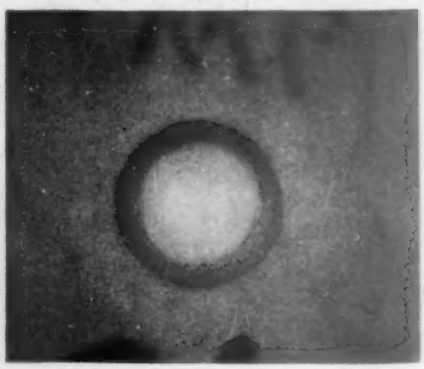
The establishment and maintenance of a control that will result in consistency of high-quality welding requires consideration of a large number of variables. Attention should first be given to those variables which can be controlled mechanically within reasonable limits. The selection of the optimum combinations and procedures for each can then be made by a process of elimination. These variables include design, preweld preparation (cleaning and handling), machine settings, performance and testing of all gauge and material combinations.

Hard to Control Variables

The variables which remain are difficult to control economically with results consistent within tolerable limits. The most important are those having to do with the surface resistances of the materials to be welded and those in which the effect of the human element is apparent. Resistance may vary for many reasons: because of variations in structures of materials from different rolling mills, varying periods of time elapsing between surface preparation and welding, variable temperatures of cleaning solutions, etc. The last-mentioned cause of variation refers to the use of hot alkaline degreasing solutions, hot rinses, etc., where there is no automatic temperature control, and the production flow varies widely in material weight from one cleaning

Fig. 5—Radiograph of defective weld with cracks, porosity and spitting

Fig. 6—A good weld. Compare this radiograph with that of Fig. 5



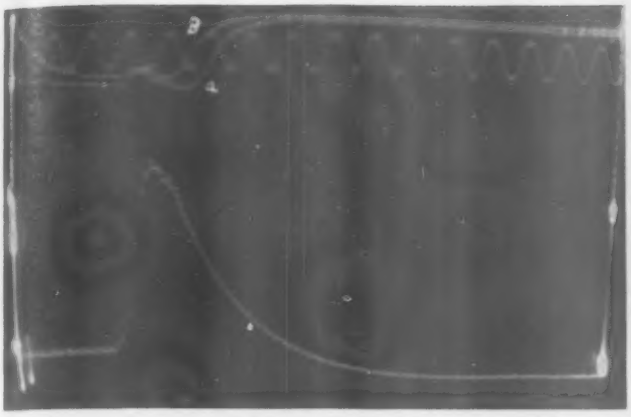


Fig. 3—Here is a 60-cycle timing wave with two consecutive machine applications: *(a)* delayed forging force application and *(b)* advanced forging force application

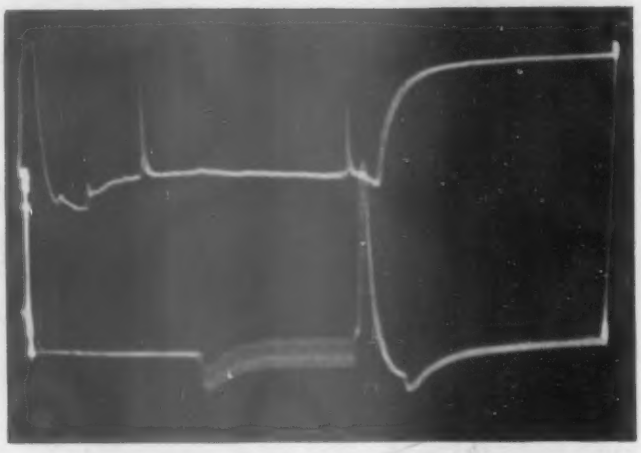


Fig. 4—An improper weld cycle. The traces indicate erratic pressure, late timing and a bad rectifier tube

to the next. In addition, the time involved before new make-up compounds (added during production) can go into solution may also affect the surface resistance.

In order to hold the preparation factor under control, it is necessary to arrive at an optimum range of resistance values within established limits. This range will function directly in schedules for welding machine settings, to be discussed later.

The establishment of a control for surface preparation involves considerable detail and requires constant attention on the part of both production personnel and laboratory technicians. It is necessary, for instance, to maintain resistance-measuring equipment in the production department for the purpose of checking each run that comes through the cleaning and etching processes. Resulting values can then be applied to the schedule charts and curves for machine set-up.

Welding Schedules

There is a fairly wide range of machine settings (current and pressure combinations) that will produce acceptable welds in a given gauge or material combination. After the particular gauge or material combination has been given, it is important to set up the weld schedule in the middle or optimum values of the range. By working in the optimum, it is possible to tolerate the results of normal variations in machine operation on either side.

A welding schedule is necessary for every gauge and material combination to be welded. Such a schedule is a tabulation of machine settings for electrode pressure, current and timing together with data on voltage, electrode contour and radii combinations and arm spacing.

Although pressure, current and time relationships must be associated, it seems that electrode pressure is first to be considered. This is established by selecting a trial pressure, and then varying all other functions until the most desirable combination has been obtained. There are certain fundamentals that will aid in the selection of the trial pressures, but even so it is sometimes necessary to work with four or five different pressure settings before obtaining the optimum. Each time the pressure value is changed, all other affected elements (primarily the current) must also be changed.

Fig. 7—These are not hot dogs on a grill but weld nuggets having both uniformity and good penetration

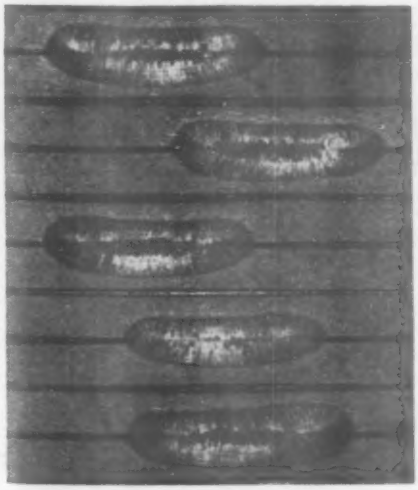


Fig. 8—These photomacrographs show slightly excessive penetration

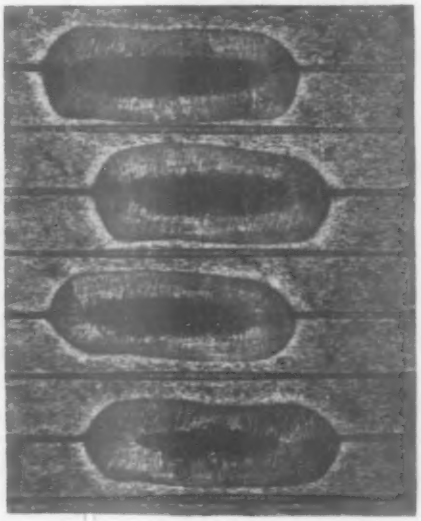
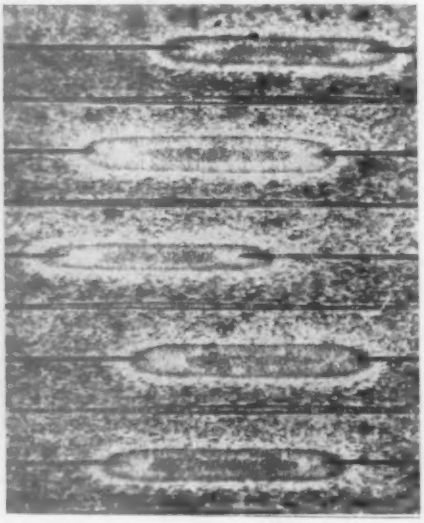


Fig. 9—Here the penetration is insufficient. Note fuzzy outlines



When using a forging action after the weld is made, it is extremely important that it be applied at the proper time relation to the current discharge. The amount of forging action allowable and necessary is largely dependent on the gauge and material combination together with the electrode contour.

What Makes A Good Weld

The optimum set of welding conditions will result in the production of welds with the following desirable characteristics: *(a)* penetration from 40 to 60% of the sheet thickness into each sheet; *(b)* nuggets of uniform shape and diameter; *(c)* weld-strength consistency with all shear values within ± 10% of the average; *(d)* sound metallographic structure with a minimum number and size of stringers and minimum inclusion; *(e)* welds radiographically sound and free from cracks; *(f)* minimum sheet indentation, good surface condition and no discoloration of the weld spots on the surface of the work.

There is a certain amount of technique required in the operation of the welding machines; i. e., tip cleaning, proper alignment of the work with respect to the tip, proper placement of spots, etc. Primarily, an operator must be able to detect trouble. If an operator is not trained in line with the control set-up and made familiar with certain detail, it is possible for him to continue making welds with a faulty current discharge, faulty timing or other cause for rejection of the work. There are a number of things that will produce a faulty weld that are not apparent to the inexperienced or improperly trained operator. It is well to check periodically the work of the machine by welding and pulling a few single-spot shear samples to compare with the set-up charts and curves.

Spot-Weld Radiographs

In the accompanying series of radiographs, Fig. 5, a defective weld, shows cracks, porosity and expulsion (spitting). Fig. 6 is a radiograph of a good weld, showing a clear outline. Fig. 7 is a photomicrograph of cross-sections of five welds in 0.032 to 0.032 in. aluminum-clad sheets. The outlines that look like hot dogs on a grill are weld nuggets; their uniformity and good penetration can be noted in this picture. In Fig. 8 the welds were made in 0.051 to 0.051 sheets, and penetration is slightly excessive. Fig. 9 shows insufficient penetration.

Welded Steel Buckets

BY CLYDE B. CLASON

The bending press and the arc welder are old partners in the rapid fabrication of many different articles. The accompanying pictures from The Cleveland Crane & Engineering Co., Wickcliffe, O., show how these two pieces of equipment coöperated to produce heavy steel buckets to be used for delivering uniformly mixed batches to the furnace of a glass plant.

Fig. 1—Steel bucket used for batch-handling system in a glass plant

The individual buckets (Fig. 1) measure 48 in. in diameter by 70 in. high and are made of 3/16 in. plate. All parts were formed on the bending press. Standard bending dies were used for most of the work, including both the main cylindrical and conical sections. The latter (Fig. 2) were formed by use of a ram-tapering mechanism, which can be so adjusted that the degree of pressure applied to a plate will vary from one end to the other of the section in contact. The amount of ram taper may be easily changed with a push-button-operated ram-adjustment drive.

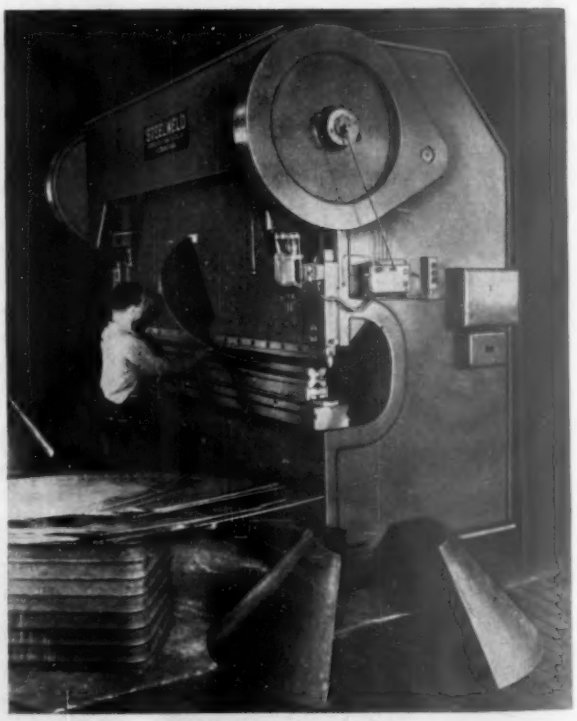


Fig. 2—The ram-tapering mechanism makes it possible to form plate into conical sections

After the various components had been formed, the arc welder was called in to finish the job by welding the longitudinal seam of the cylindrical section, making the circumferential weld that joins the steel cylinder and cone and adding the gate, gate arms and various clips that had been previously formed on the bending press.

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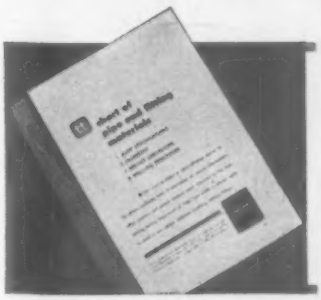

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★ PRODUCTION

Welding Bulldozers on an Assembly Line

BY WALTER J. BROOKING
Director of Testing and Research
R. G. LeTourneau, Inc., Peoria, Ill.

Fig. 1—This all-welded, cable-actuated bulldozer was required in large numbers for military operations on almost all fronts. A special mass-production plant was organized to build them

★ Part One—Large, heavy bulldozers had to be tailor-made in the old prewar days. Now they're turned out on a mass-production basis, and every tiny detail of welding is standardized.

THE bulldozer shown in Fig. 1 is, together with its supporting A-frames and power control unit, accessory equipment to the tractor upon which it is mounted. A common peacetime construction tool, the bulldozer was found to be a highly efficient instrument of war almost immediately after hostilities started. As far back as early 1943, it became evident that large numbers of these units were to be used on almost all Allied fronts.

Planning for Production

In order to accommodate the large orders placed for the two different sizes of this model, it was necessary for R. G. LeTourneau, Inc., to develop, lay out, tool up and organize additional floor space for assembly of these units. The only space available was a rather old frame building which had no overhead crane facilities and lacked the structural strength to support such overhead means of transportation. It was decided, therefore, to do such operations as flame-cutting, shearing, bending, pressing, forming, blanking, etc. in the main plant, located within an eighth of a mile away.

The capacity of the main plant cutting department, with a small amount of additional equipment and longer working hours, was sufficient for the shearing, flame-cutting and forming operations. Hence, the problem of organizing to produce bulldozers in the new building resolved itself largely into one of establishing control of the parts after they had been produced in the regular plant according to regular manufacturing procedure.

The production department's control of the operations performed in the new plant was centered about the stock control room shown in Fig. 2. Here the small parts for each unit were stored, and the largest structural parts were checked in before being placed in storage racks located near the fixtures into which they were to be assembled. The bins shown in the picture were of

Fig. 2—Section of bulldozer parts control room. Note the welded steel storage bins for parts and electrodes

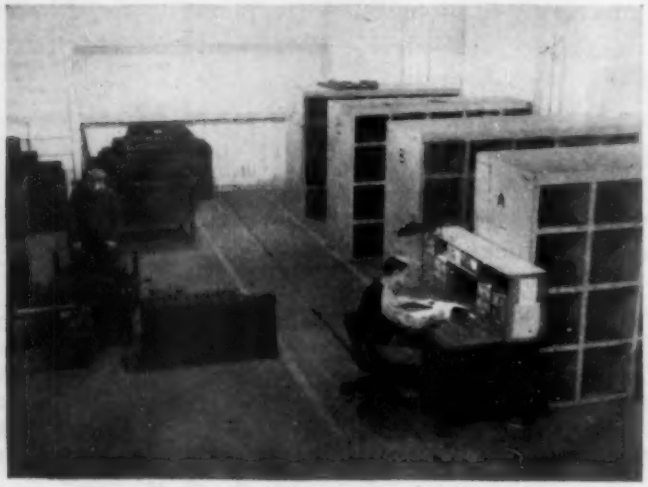

Fig. 3—View of the bulldozer welding department. Note the jib crane located between posts 5 and 6

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Fig. 4 (left)—A bulldozer body is being transferred from its production fixture to the monorail system that is used for the transportation of heavy parts

Fig. 5 (right)—Handlift buggy, skids and bins provided elastic handling of small parts and structures. Note welded construction of skids and bins

Fig. 6 (left)—A special die enabled hoist sheave side plates to be formed, punched and trimmed in one operation

a standardized design and made of arc-welded light-gauge steel. They required a comparatively small amount of material and workmanship and gave a very effective use of space and storage capacity. Welding electrodes were also stored in the stock control room.

Welding Assembly Line

The general plan of operation was to start the assembly line with the welding of small substructures. The small-substructure welding department was established at the end of the plant nearest the storeroom (which was just inside one corner of the building). This was followed progressively through the building, by the welding of the larger, main-body structures, including the supporting A-frame structure, at the far end of the welding department. The assembly line then continued for cleaning, painting the prime coats on the welded structures and finish painting. Finally, the completed unit was driven out into the yard and loaded onto a flat car.

Fig. 3 shows a view of the shop from the end of the small-substructure welding department. A welding booth for the small-substructure department is shown at the extreme left by post No. 3, followed by the larger-structure welding fixtures and stock piles. Jib cranes, such as the one appearing between posts 5 and 6, provided the means of handling most of the large structures and heavy parts in this manufacturing line without overhead crane facilities. The jib cranes were weld-fabricated within the plant, and they were designed to give maximum floor coverage with the greatest possible height of lift.

The structures were moved on overhead monorails from the fixtures in which they were made. The beginning of monorail transport is shown in Fig. 4, where a bulldozer main body is being suspended on the trolley hooks, using a jib crane for the transfer.

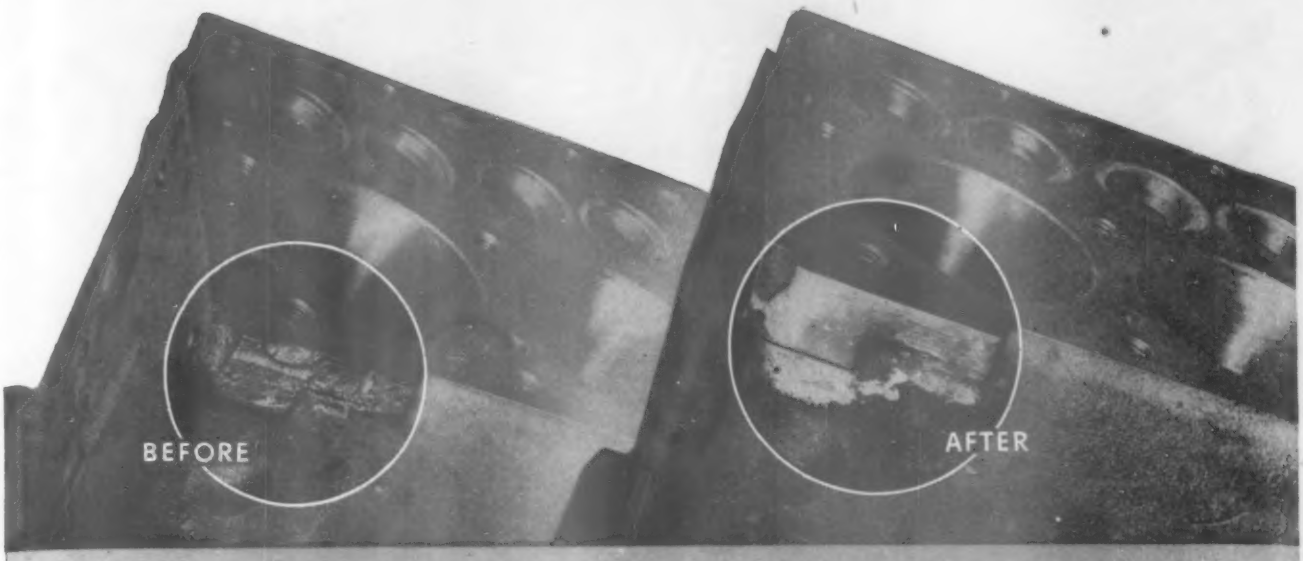
The overhead monorail system was suspended from the timbers of the building, just beyond the reach of the jib cranes on one wing of the building. It passed through the welding department and thence through the sand-blast booth, cleaning section and painting department before looping back through the assembly section.

Power, Plumbing and Piping

All major power lines and pipes for water, compressed air, oxygen and acetylene were established above the rafter line and dropped down to the jib crane, flame-heating fixture, paint booth lathe or other unit served. This layout kept the majority of the plumbing and piping out of the way and permitted the use of jib cranes and similar pieces of equipment with the minimum of restriction by pipes, conduits, wires, hoses, etc.

Incoming trucks carrying parts for the larger structural members were simply backed down the middle aisle of the plant until the truck was adjacent to the rack in which the part was to be stored. The nearest jib crane was then used to do the unloading.

The general plan of the plant layout was carefully engineered to provide the least handling of materials from the



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"AC-1"	AWS E-6011
"AP"	AWS E-6010

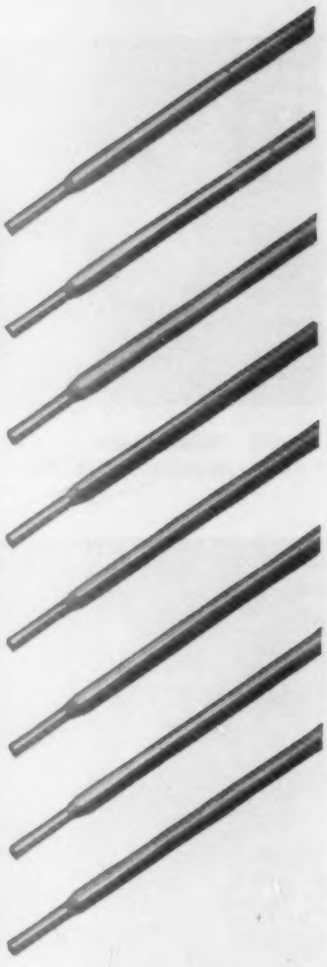

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Fig. 7—Special care was exercised in making and using the templates for automatic flame-cutting operations

Fig. 8—These flame-cut members were accurately laid out and cut to avoid expensive variations in fit-up

Fig. 9 (left)—Individual welding booths, set-up fixtures and positioning fixtures were made for small structures

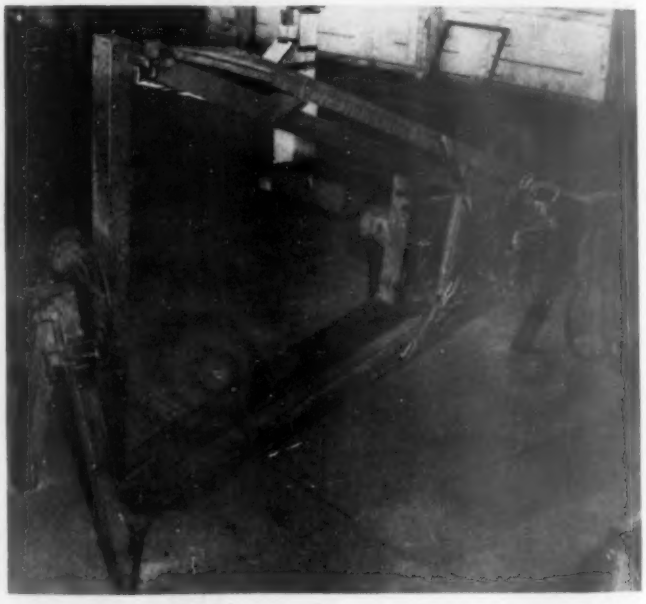

Fig. 10 (right)—These "Spinner" jigs for the A-frame structure combined set-up stops and clamps with positioning about one axis

time they were lifted off the truck and placed in the racks until they left the welding department as finished structures. Note in Fig. 3 the proximity of the racks of structural parts to the welding fixture in which they were set up.

A handilift buggy, transportation skids and bins (Fig. 5) conveniently transported small substructures and small parts to different parts of the plant.

Improvements in Forming

As before explained, most of the cutting and processing on the structural parts for bulldozers was done in the regular cutting department in the main plant. Mechanical processing facilities were already available, but the increased amount of processing demanded increases in the efficiency of some operations. Such improvements in efficiency were mostly effected by the elimination of operations, combining of operations and speeding up of operations through the design of better dies or tools. An example of the latter is the die shown in Fig. 6, which eliminated some shearing and flame-cutting in the production of hoist sheave housing side plates.

These hoist sheave side plates were originally sheared and then blanked and formed under separate bending, blanking and punching dies. Prior to the time that bulldozers were ordered in quantities, the number of hoist sheave housings made did not justify the cost of a special die. To increase production, the die shown in Fig. 6 was made. It permitted the parts to be formed, blanked and punched hot, all in one operation, under a 500-ton hydraulic press. The die itself was largely made by flame-cutting the bed and the cutting edges, grinding them down to dimensions and then hard-facing the wearing surfaces.

Emphasize Cutting Care

Special attention was paid to the flame-cutting of these bulldozer parts. Care was taken that the templates used on multiple-torch cutting machines (Fig. 7) were accurately made to produce a piece with the proper tolerances. Careful adjustment of the machine, careful storage of the templates and careful attention by the operator were all needed to insure properly fitting parts.

The same care was taken with all of the manual cuts, of which the long bevel cuts on the supporting A-frame structure parts and the main push-beam structure parts shown in Fig. 8 are good examples. A good-fit for such parts was extremely critical to

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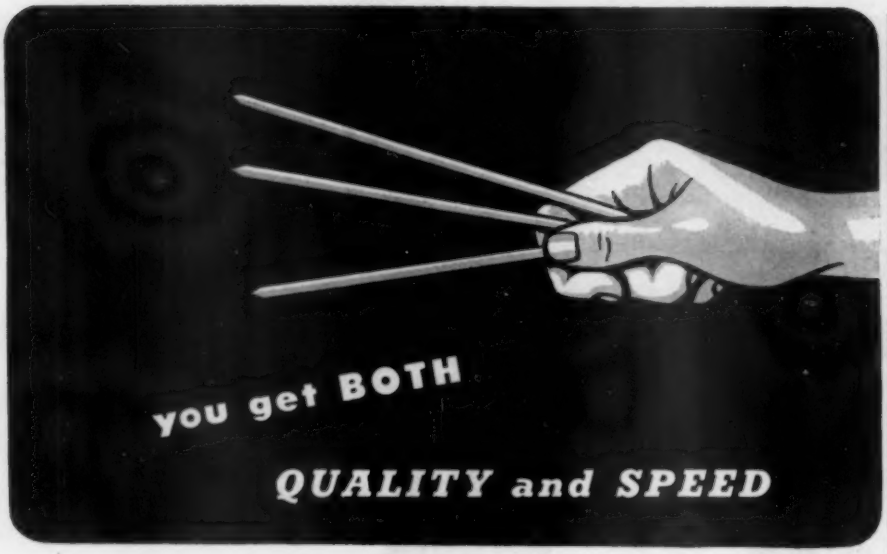

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the length of time required to weld them, since a slight error in a long bevel cut may produce gaps which take as long or longer to fill than the time needed to weld the joint when the fit-up is correct. Such gaps are expensive to fill and upset production schedules. They can be kept to a minimum by careful flame-cutting.

The bending, rolling, forming and premachining of most of the bulldozers parts was done before they left the main plant. The formed and machined parts were then transported to the bulldozer plant, checked into the stockroom and checked out according to schedule for the welding department.

Welding Standardized

The organization and set-up of the welding operations was carefully planned so that they could be standardized in every respect. Special set-up fixtures (usually combined with welding fixtures) were used to eliminate as much measuring and adjustment as possible. Weld-positioning fixtures were provided so that welds could be turned to the most favorable position. The stepwise procedure for the construction of every structure and unit was established on written check sheets, and the specifications for every weld were placed on the blueprints. These detailed specifications included the location of the weld on the structure, its size, its cross-sectional view, number of passes needed, size and type of electrode to be used and the machine setting for each pass. Finally, time studies were taken on the different processes of production, and the whole production line was oriented upon a controlled time schedule.

Under this completely standardized basis, small substructures were set together in set-up fixtures and welded in small booths and individual positioning fixtures (Fig. 9). Positioning fixtures, such as the one shown in Fig. 10 for the supporting A-frame, were designed and built in the shop. Wherever possible, combination set-up and positioning fixtures were provided for the major structures.

(To be Concluded Next Month)

Walter Brooking in New Position

Since writing the above article on bulldozer production for The Welding Engineer, Walter J. Brooking has been advanced to a new position with R. G. LeTourneau. Mr. Brooking is now dean of the LeTourneau Technical Institute at Longview, Tex.

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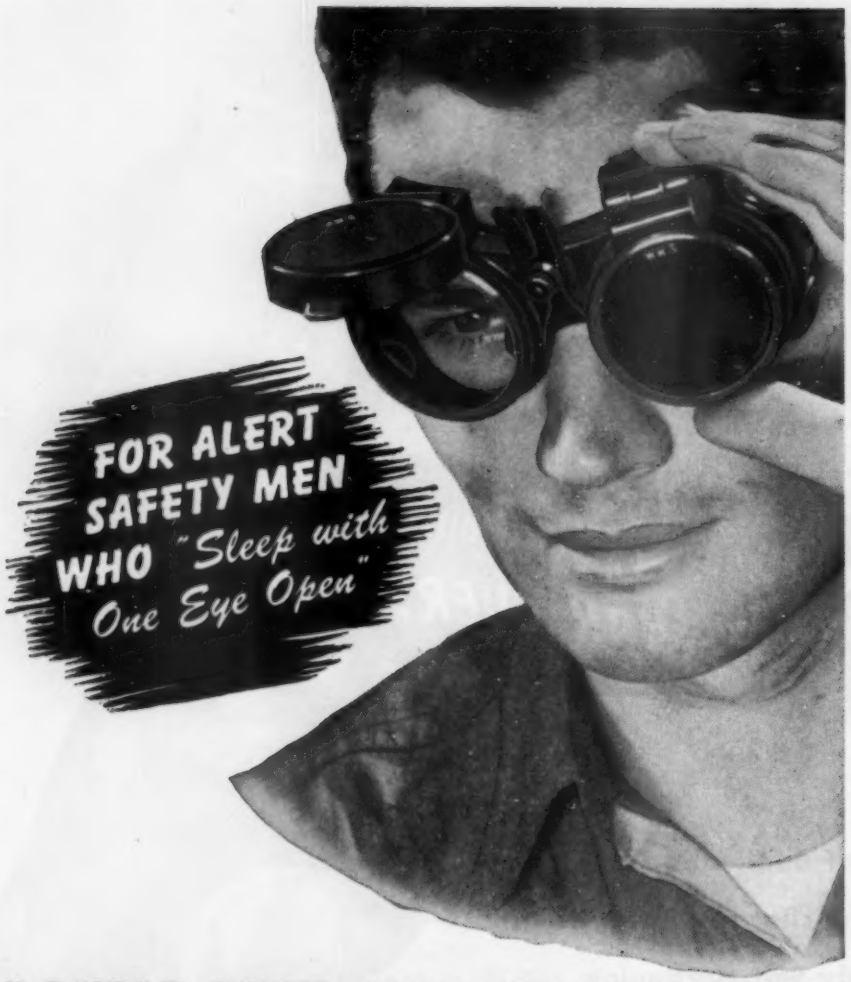

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(Continued from page 45)

electrodes. The complete conical end was prefabricated on the concrete subassembly base; this arrangement speeded up production and permitted the maximum amount of downhand welding. The only positional welds required were those to connect the subsections to the parent unit. The cone was connected to the drum by means of a circumferential weld and a closure plate. The flanges were prefabricated at the works in large sections and transported to the site; again this arrangement allowed the maximum amount of downhand welding.

Fig. 4 gives some indication of the size of the completed structure; one of the heavy roller-bearing trunnions used for towing can be clearly seen in this picture.

The success of the methods employed can be gauged from the fact that only nine months were required for the complete job (Conuns II to VI) from the first delivery of steel to the final launching. In view of the blackout restrictions (the site was in one of the blitz areas), this was a remarkable accomplishment. Conun I, the prototype, was completed and tried out before it was decided to proceed with the five additional sister vessels.

During pipe-laying operations in heavy weather, one of the Conuns broke adrift and was driven ashore. The Conun was designed to carry its load when supported by water, and it was expected that it would collapse when the tide receded; however, beyond some buckling of the flange, the ship was undamaged and was ready for immediate service.

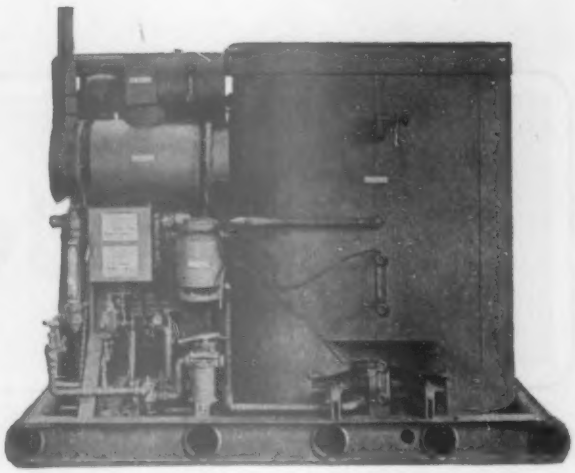
Two of the Conuns, which had been moored fully loaded at a naval base, were recently opened for inspection. To use the words of the naval officer in charge: "There was not a spoonful of water inside."

The following figures on the project should be of general interest:

An average of 90 welding operators were employed, working two shifts; 270 miles of electrodes were used; 11 acres of steel (reduced to plate ¼ in. thick) were used; 20 acres had to be painted.

Acknowledgement is due to Messrs. Orthostyle Limited for their coöperation in making the above information available.

ANOTHER INSTANCE OF CARBON ARC WELDING with Chase Olympic Bronze



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On the Job

Analyze Truss Stresses

TO SECURE fundamental research data for the further development of welded H-section trusses of long span and unusual framing, The Austin Co., Cleveland, recently concluded a series of tests that revealed in detail how the stresses flow through truss joints of this type. The tests were conducted on a pair of 80-ft standard trusses (taken from the stock on hand at the Austin fabricating shop) under direction of H. D. Churchill, professor of engineering mechanics at Case School of applied Science.

The Austin H-section trusses were originally designed in 1943 and subsequently the H-section was adopted as a standard for use in welded trusses of 50, 60, 70 and 80 foot lengths. These trusses are fabricated completely from rolled members, which are flame-cut to the desired length and assembled with their webs in a single vertical plane. The 50-ft trusses used in the initial 1944 field test failed when an end vertical buckled under a load 253% of the design load.

In the recent tests, a total of 144 strain gauges, made by the Baldwin Locomotive Works, were attached to the joints at both ends of the first diagonal and at certain other important points. They were placed at the same locations on both trusses to provide a check. These strain gauges make it possible to measure instantly the average strain in a ½-in. length to one-millionth of an inch.

The gauge itself (Fig. 1) consists of a tiny loop of copper-nickel wire with a diameter of 0.001 in. Finer than a human hair, this wire is cemented to the steel surface so that it will change in length exactly as does the steel on which it is mounted. The stretching causes the diameter to decrease and the change in diameter changes the resistance. The change in resistance is of course extremely small, but it is multiplied by electronic equipment to the point where it can be measured by recording devices.

The test loads were applied by placing 60-ft lengths of structural steel on the trusses in a manner which concentrated the full load on purlins located directly above the vertical truss members. The strain measurements were recorded by three automatic switching units and three SR-4 strain recorders. Each pair of instruments (switching unit plus a recorder) made an automatic written record of the strains at 48 gauge points, so that 144 individual strain readings could be recorded in about two minutes. More than three miles of wire were required to connect the gauges to these instruments (see Fig. 2).

The first test was made under a load somewhat over the design load, after which the entire load was removed.

In the second test, held on the following day, the trusses were loaded to a total of 254,000 lb. This was the equivalent of dead load represented by a cement tile roof deck plus twice the live load figured at 35 psf. The maximum deflection with this peak load in place was about two inches.

After the peak load had been reduced to 196,000 lb, this load was left on the trusses for three days, and the third test was then completed. After removal of the total live load, both trusses showed a maximum residual deflection of ☆ in.

Approximately 3,000 strain readings were recorded at intervals during the loading and unloading in the tests as well as under the peak loads. All of the readings indicate that satisfactory truss action was taking place throughout both trusses at all times, said J. K. Gannett, Austin vice-president and director of engineering and research.

☆ ☆

Production Brazing

ONE OF the lesser known but still widely used applications of the spot-welding process is production brazing. Slight modifications permit standard spot welders to be readily adapted for this work, reports the Thomson Electric Welder Co.

One example is the use of an air-operated press welder for brazing tips to tool bits. The work is performed under water, which circulates through a box mounted on the knee of the welder. Heating of the work is still further avoided by the use of dual electrodes, each connected to a secondary transformer terminal. Quick follow-up electrodes are used to maintain pressure when the brazing material reaches the flowing stage.

Another machine was adapted for resistance brazing of large work or extensive areas by removal of its electrodes and substitution of carbon contact blocks mounted on the water-cooled platens. The conventional water-cooled spot-welding electrodes can be employed, however, for the spot brazing of small pieces or limited areas.

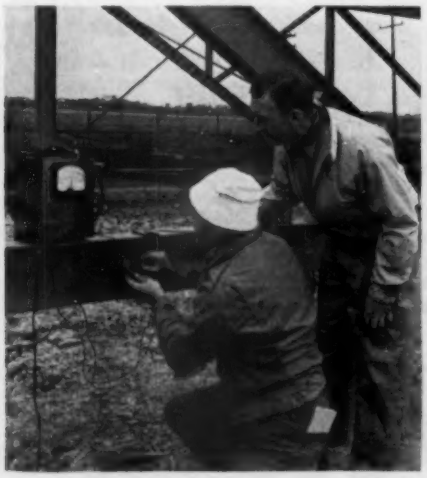

Fig. 1—Harry Nara and L. J. Reardon, assistant professor of applied mechanics at Case School of Applied Science, are testing one of the strain gauges in preparation for the tests on a pair of 80-ft welded H-section trusses at the Austin field testing laboratory

Fig. 2—Approximately three miles of wire were required to connect the 144 strain gauges to the recording instruments, which were located in a small building alongside. This picture shows one of the concentrations of lead wires at the end of the trusses nearest the instruments. Professor H. D. Churchill of Case School of Applied Science (left) is discussing the reaction with W. G. Paton, Austin vice-president (center) and A. T. Waidelich, assistant research director of the company

Welded Platform Jack

By Elton Sterrett

TO ADJUST working platforms to level over uneven terrain, the weldor of one contracting crew devised a screw-type support which could be quickly adjusted as to height

To adjust the span of this jack, a pipe wrench is used to turn the stud within the nut

and gave ample strength to carry any load the metal flooring could sustain.

A short section of 1½-in. extra heavy pipe was welded in the center of a 1-ft square of ½-in. boiler plate. The upper end of the pipe was capped with a 1¼-in. nut, engaging the thread of a 1¼-in. stud. The upper end of the stud was covered by a short 1½-in. pipe nipple, welded, like the base of the pipe, to the center of a square steel plate. The upper end of the stud was free to rotate within the recess formed by the short nipple and the top plate when the stud was turned within the supporting nut by means of a pipe wrench.

A handle was welded along one side of the 1½-in. pipe to simplify placing the jack.

☆ ☆

Tailor-Made Tubing

BY USING the oxy-acetylene pressure-welding process, one manufacturer manufactures tailor-made boiler tubing of any desired length from standard tube stock. The tube lengths to be welded are clamped in the machine and subjected to hydraulic pressure while being heated by a ring-type oxy-acetylene heating head (see picture). In a short time, plastic upsetting of the butted edges occurs, producing a weld of high quality.

Welding boiler tubing by the oxy-acetylene pressure-welding process. This close-up of the joint shows beginning of plastic upsetting

Courtesy, The Linde Air Products Co.

for
FAST,
EASY
CONTROL
Specify
TITAN
BRONZE
WELDING RODS
★ Titan bronze welding alloys are doubly deoxidized to remove occluded and dissolved gases picked up in the melting. This process prevents the absorption of gases from the torch, from the atmosphere, and from the job itself.
Titan's carefully controlled double deoxidizing process also increases the ductility of the weld, produces a sound dense deposit, and reduces fuming to a minimum.
Mobile, yet easily controlled under the welders torch, Titan welding rods penetrate seams and crevices readily. They are free flowing at 1625° Fahrenheit.
Welders knowing the importance of "uniformity" demand it and are certain of getting it when they use Titan Bronze Welding Rods.
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METAL MANUFACTURING CO.
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BRANCH OFFICES IN PRINCIPAL CITIES
Quality Alloys By Brass Specialists
Brass and Bronze Rod • Forgings • Die Castings • Welding Rods

Jeep-Welder Combination

A CIVILIAN version of the famous Army jeep is used on the 200-acre farm of William Durr, Staunton, O.—thanks to Farmer Durr's son! This ingenious young man had driven a jeep during his four-year stretch in the Army, and he thought it would be ideal to use on the farm. Farmer Durr's son had also learned welding while in the service, and he didn't see any reason why this knowledge couldn't be put to work.

The result of combining the two themes is a utility jeep with a detachable welding generator driven from the jeep's engine. The 200-amp generator is securely bolted to the jeep flooring and is coupled to the power takeoff by four V-belts. This handy portable welding outfit is used for making speedy repairs to equipment at the barn or in the field, or wherever a breakdown may occur. Durr's son also employs it to improvise needed farm equipment that is not immediately available.

Courtesy, The Hobart Brothers Co.

This portable welding outfit and utility truck makes possible quick repairs to farm equipment

☆ ☆

Overlaid Fair-Lead Carrier

THE rough service conditions encountered by heavy earth-moving machinery and the fact that such outdoor equipment is often used miles from repair facilities render it imperative that the vital wearing parts be protected. Particularly is this true of bearing surfaces, which are required to withstand extreme wear under heavy pressures.

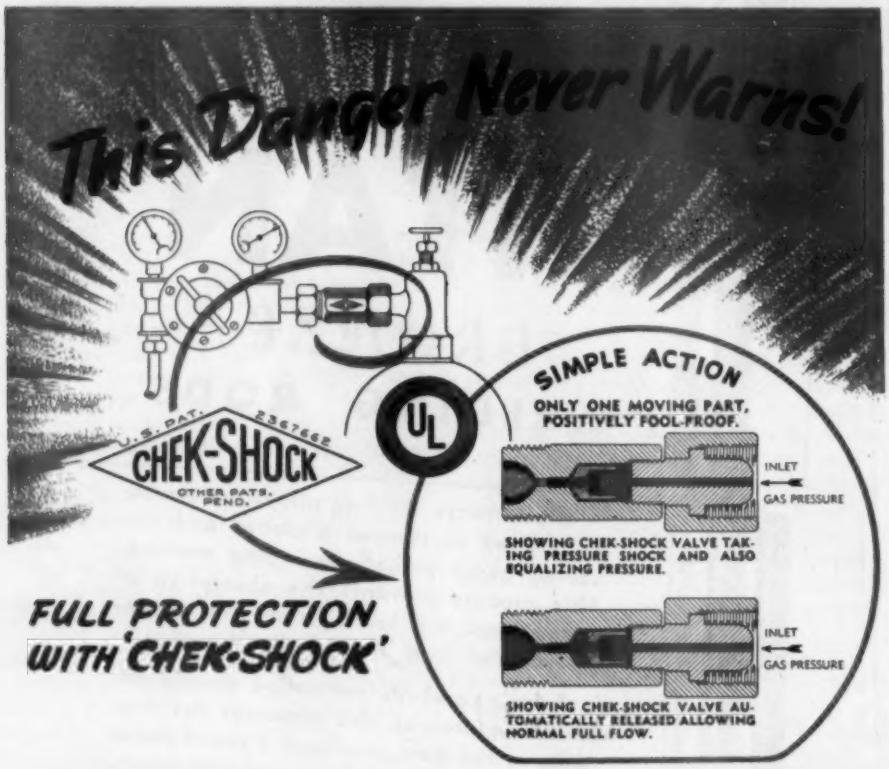
One example is the fair-lead carrier on the "Hystaway," a versatile piece of equipment serving, with minor adjustments, as a crane, a dragline, a clamshell or a bulldozer. The Hystaway is manufactured by the Hyster Co. of Portland, Ore., and Peoria, Ill.

The fair-lead on the mast, through which the ropes are guided, had had a very short life due to extreme wearing conditions at this critical point. It was decided to overlay the wear plate at the bottom of the fair-lead carrier with a welded deposit of aluminum bronze.

The wear plate was overlaid ¼ in. on both sides, using a coated aluminum-bronze electrode having an average hardness of 250-260 Brinell. Life was greatly lengthened at comparatively small cost.

Courtesy, Ampco Metal, Inc.

Fair-lead carrier of earth-moving machine overlaid with welded deposit of aluminum bronze



CHEK-SHOCK OXYGEN CUSHION VALVE

SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will increase life of regulator assembly.
- Will eliminate possible injury to operator from burstings.
- Will prevent unnecessary internal wear in regulator *(as NOT necessary to release control screw before opening tank valve).*

This PROVEN automatic safety device cushions the initial "blast" of pressure when tank valve is turned on, (this uncontrolled surge which strikes like a hammer is the direct cause of most damaged regulators and accidents), when pressure slowly bleeds and equalizes then CHEK-SHOCK allows a full flow of oxygen.

PRICE IS LESS THAN ONE REPAIR BILL

1. STANDARD COUPLER—for all standard size welding type oxygen regulators.
2. LIGHT COUPLER—for "airplane" or soldering size oxygen regulators.
3. HEAVY DUTY COUPLER—recommended for extra heavy duty work only.
4. SCREW TYPE COUPLER—for removable inlet stem regulators (¼" pipe) available in standard, light, or heavy capacities.

$6.00 ea.

5. FOR HYDROGEN—left hand thread coupler. We also make Medical Chek-Shocks for all types of medical regulators and tank fittings (chrome plated).....$7.00 each

SEE YOUR DISTRIBUTOR OR WRITE

Chek-Shock MFG. CO.

FOWLER CALIF.

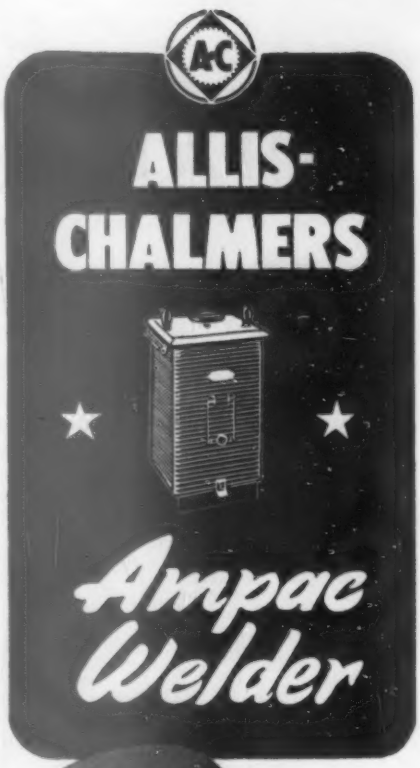
Better Power Factor..Lower Power Cost

AVAILABLE THROUGH *MAGIC ARC CONTROL*

What It Is: Automatic regulation of arc striking voltage through the medium of a special a-c welding circuit . . . *that's magic arc control* — Ampac's key to finer, better welding. Transformer and reactor are combined in an integrated core-coil arrangement . . . providing Ampac with a *variable* open circuit voltage. Result: it steps up arc striking voltage at low currents to make welding easier . . . and cuts down excess striking voltage at high currents to reduce power consumption. You get *correct* striking voltage every time through *magic arc control!*

How It Helps You: High voltages for heavy currents are *not* necessary to strike and maintain an arc. So Ampac automatically uses low voltages at high amperages to reduce power input . . . increase power factor . . . and cut power bills! *Low current* welding is easy with Ampac because striking voltage is automatically *stepped up* — to give you a faster, easier-to-strike arc! You benefit through *better* light metal welding, *more economical* heavy duty welding. Get full details on Ampac magic arc control welders from our nearby dealer or district office. Also inquire about Allis-Chalmers electrodes and welding accessories. ALLIS-CHALMERS, MILWAUKEE 1.

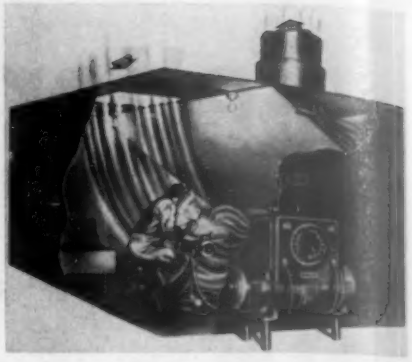
A 1994



New Products to Use

Production Welding Booth

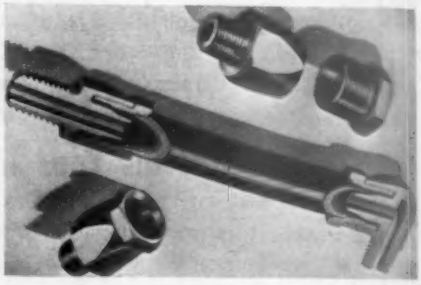
BEING planned for future production is a new fresh air, safety welding booth, which will be 9½ ft wide, 9¼ ft deep and 7 ft high. The booth will be constructed of fabricated panels of 16-gauge sheet steel, formed with companion flanges and punched on a 12-in. center for bolting assembly. The door, measuring 43 in. wide by 78 in. high, is of the sliding type with rollers running along an overhead track.



Hobart's planned production welding booth

Fresh air is drawn in through an opening in the top by a heavy-duty exhaust fan. The air is circulated past the operator to pick up welding fumes and heat and is then expelled to the outside of the building. The booth thus serves a double purpose in providing improved ventilation and safeguarding workers in other parts of the plant from the effects of the welding arc. THE HOBART BROTHERS CO., Troy 1, O.

☆ ☆

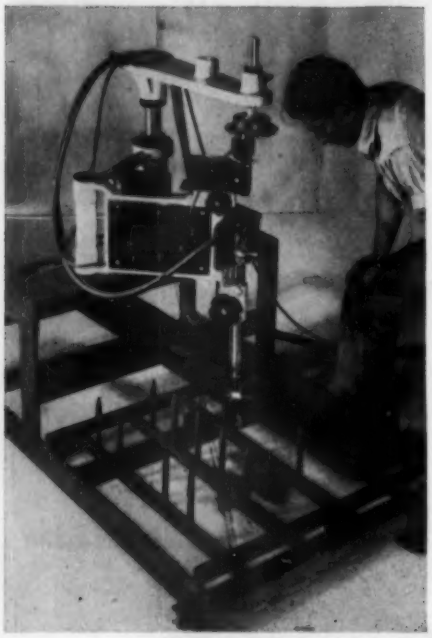


Reusable couplings for flexible hose lines

Hose Couplings

A LINE of detachable two-piece couplings makes possible the hand assembly of flexible hose lines. The nut threads onto the hose with coupling shell compressing the hose end into a "safety-seal" gasket. The double bell shape of the nut permits the hose to flex without cutting, and the heavy body of the fitting prevents crushing or distortion of the line. RESISTOFLEX CORP., Belleville, N. J.

ACCURATE SHAPE CUTTING



FLAME CUT SPROCKETS that require no further finishing are just one of the many accurate jobs the O.M.W. will produce. These flame cut sprockets will fit roller chain, when they drop from the plate being cut. No additional machining is necessary. Automatic reproduction from steel templets has been made simple and easy by magnetic control, no matter how difficult or complex the shape. The O.M.W. will prove its worth in both manufacturing and maintenance work. A demonstration in your plant can be arranged. Write for the name of your nearest distributor.

SPECIFICATIONS

OVERALL DIMENSIONS	36"x60"x58" High
MAX. THICKNESS OF CUT WITH STD. BLOWPIPE	8"
CIRCLE CUTTING RANGE	0"—30"
STRAIGHT LINE CUTTING	65"
CUTTING SPEED, INCHES PER MINUTE	3"—30"
ELECTRICAL REQUIREMENTS	115V—AC or DC
NET WEIGHT WITH SEMI-STATIONERY BASE	534#
NET WEIGHT WITH PORTABLE BASE	347#

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Experienced WELDERS PREFER THEM

THERMACOTE • CLEAR COVER LENS
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THERMACOTE Plastic Coated Cover Lenses, slag-proof and water-proof, outlast ordinary cover glasses 25 to 1. Preferred by welders because they insure constantly clear vision and save eye strain.

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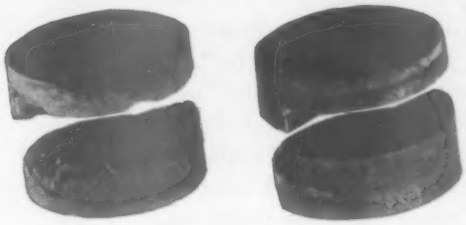
4 to 5 Times LONGER LIFE

Dressing Time REDUCED BY TWO THIRDS

and here's the proof!



UNTREATED **TREATED**

(Actual unretouched photo)

At left . . . Ordinary carbon brazing tips ready for the discard after only 500 operations. *At right* . . . Stackpole "F" treated brazing tips still ready for a lot more use AFTER 1300 OPERATIONS on the same job!

CARBON BRAZING TIPS

...with the famous Stackpole "F" Treatment

STACKPOLE'S recently developed "F" treatment for its Carbon Brazing Tips has resulted in units that operate at temperatures above red heat, require dressing far less often, and increase tip life four to five times that of untreated carbon by minimizing oxidation.

"F" treated Tips can be produced in practically any required shape or size. Their resistance to cracking or spalling permits the application of more radical temperature changes than is possible with any other material.

OTHER STACKPOLE PRODUCTS

BRUSHES
(All types for all rotating electrical equipment)
CONTACTS
(Carbon, graphite, metal, rare metal, and composition types)
PACKING, PISTON and SEAL RINGS
RHEOSTAT PLATES and DISCS
VOLTAGE REGULATOR DISCS
ANODES—ELECTRODES
POWER TUBE ANODES
WELDING CARBONS, etc., etc.

STACKPOLE CARBON COMPANY, ST. MARYS, PA.
EXPORT: Stackpole Carbon Co., 254 W. 34th St., New York 1, N. Y., U. S. A.

SAMPLES . . . sent for test. State size and shape. Mention company affiliation.

STACKPOLE

Billet Furnace "Skid Pipes" Serve 16 to 18 Months Hardfaced; 6 to 8 Weeks Without it . . .

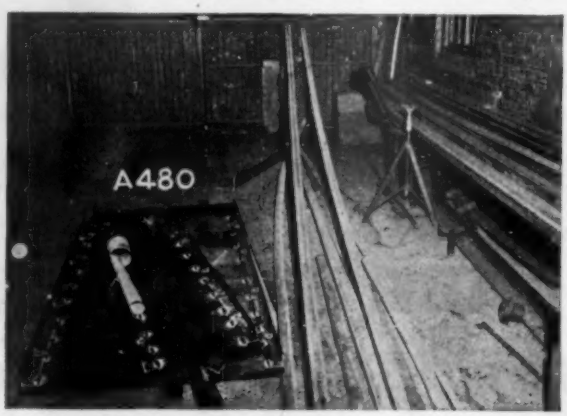
A cost item which sometimes can be lowered in rolling mill practice is the maintenance of billet heating furnace "skid pipes." One type of furnace uses four to six 2-inch double extra-heavy pipes, approximately 60

feet long, as shown in Picture A-480. These water-cooled pipes when unprotected by hardfacing material ordinarily last from six to eight weeks in their task of supporting billets on their trip through the heating furnace.

Picture A-482 shows the interior of the discharge end of a billet heating furnace, with white hot billets lying on top of the skid pipes. Furnace maintenance men are well aware of the man-hours involved in changing furnace skid pipes; to which must be added the cost of new pipes. They also know the inconvenience and disruption of production that occur when furnaces develop leaks from wear.

Amsco No. 459 Welding Rods have solved these problems by increasing the service life of rolling mill skid pipes from the usual six to eight weeks to sixteen to eighteen months, with corresponding savings. Picture A-483 shows skid pipes, hardfaced with Amsco No. 459, which had actually been in continuous service eighteen months. It is apparent that there is still a considerable quantity of weld metal on the pipes, which will be resurfaced and used as spares.

Amsco No. 459 is a cast rod of high chromium, molybdenum and carbon content that provides sound welded deposits with a Brinell hardness of 500-600. It is ideal for parts encountering severe abrasion and moderate impact, such as rolling mill guides, drag chains, coal cutter bits, dipper teeth, muller and mixer parts, and pump shells and impellers.



Joliette Steel Limited, Joliette, Quebec, owned by American Brake Shoe Company, produces and sells Amsco Manganese Steel Castings in Canada.

AMSCO

Foundries at

Chicago Heights, Ill.; New Castle, Del.; Denver, Colo.; Oakland, Calif.; Los Angeles, Calif.; St. Louis, Mo.

Offices in Principal Cities

AMERICAN MANGANESE STEEL DIVISION

CHICAGO HEIGHTS • ILLINOIS

AMERICAN Brake Shoe COMPANY

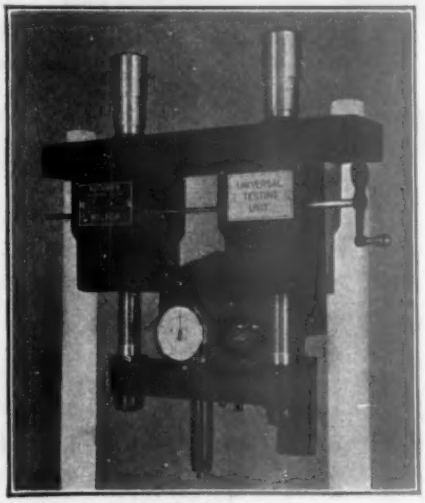
Duo-Welder

THE need for a separate spot welder and gun welder is eliminated by a new combination unit developed to weld structural and sheet metals ranging from 28 gauge to ¼-in. This provides a 50-kva spot welder with a 36-in. throat and a gun welder having interchangeable yokes for different jobs. The spot welder is put into operation by detaching the gun welder yoke and bolting the pressure cylinder unit to the upper arm.

The transformer has eight heat taps, and air valve, pressure boosters and water manifold are mounted on the frame. The oil-operated gun gives pressures up to 2,000 lb and is counterbalanced by a specially designed arm using the transformer for weight. All yokes, points, cables and transformer are water-cooled to meet severe production service. The controls are automatically operated, electronic-tube contactors and repeat timers. Flexible rubber-coated wire leads permit the machine to be moved to any part of the shop. ACRO WELDER MFG. CO., 1825 W. St. Paul Ave., Milwaukee 3.

Combination gun and spot welder for sheets ranging from 28 gauge to ¼ in. thickness

☆ ☆



New Rockwell tester for large and heavy work

Rockwell Hardness Tester

BY USE of a new Universal testing unit, large gears, rolls and other heavy pieces can now be successfully tested for Rockwell hardness. The standard testing unit is furnished for mounting in a rigid frame of whatever design the user builds to meet his specific needs. The manufacturer supplies only the portion appearing dark in the illustration. WILSON MECHANICAL INSTRUMENT CO., INC., 383 Concord Ave., New York City.

Phos-Trode gives you these advantages:

- Shielded-arc characteristics . . . good manipulation in all positions . . . short arc.
- A dense deposit, free from porosity.
- Excellent physical properties.
- Superior, feather-edged bead contours.
- Very low spatter loss . . . high deposition efficiency.
- DC only . . . for high-speed, quality welding of cast iron, steel, bronze, and brass.
- A companion electrode to AMPCO-TRODE coated aluminum bronze electrodes.

Full details on Phos-Trode upon request

AMPCO

Phos-Trode is a product of

Ampco Metal, Inc.

Phos-Trode

Shielded-Arc Phosphor Bronze Electrodes

have improved arc deposition characteristics that solve many "Phos-Bronze" welding problems

Phos-Trode, thoroughly tested in the field, has proven its ability to weld cast iron, steel, bronze, and brass with a high degree of success.

In fact, one enthusiastic user tells us, "We now have a rod that suits our purpose completely . . . it offers no trouble in machining . . . we get good, sound welds on large and small cast iron and bronze parts."

Check the advantages at the left to see how completely Phos-Trode shielded-arc electrodes solve your welding problems. There is an Ampco field engineer or distributor nearby who will be happy to give you full details. Or, mail the coupon to us for the latest Phos-Trode Bulletin.

W-92

AMPCO METAL, INC., Dept. WE-8, Milwaukee 4, Wisconsin

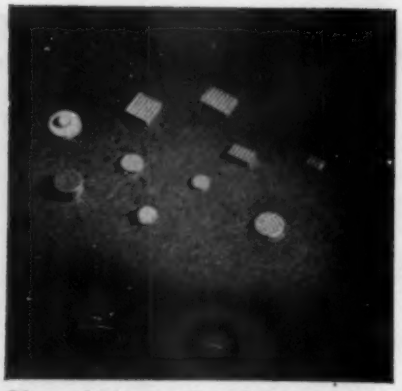
Please send me complete information about Phos-Trode.

Name..... Position.....

Company.....

Address..... ☐ Home ☐ Office

City..... (.....) State.....



Silver-molybdenum alloy eliminates welding or sticking of contacts when using high current

Silver-Molybdenum Alloy

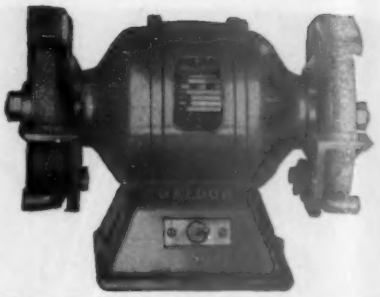
A NEW high-conductivity silver-molybdenum alloy (Callinite type SM) is available for facing switch gear contact surfaces, etc. It is designed to handle heavy currents and avoid pitting, sticking or welding of contacts. CALLITE TUNGSTEN CORP., Union City, N. J.

☆ ☆

Electronic Timers

A NEW series of electronic timers built to control resistance-welding is offered in ranges from 0.05 to 0.5 seconds, 0.1 to 10 seconds and 1 to 100 seconds. Basic models may be obtained with any one of three different circuits, the choice depending upon the operating sequence desired. Output contacts for various load conditions are also available.

The only moving part is a fast-operating relay having a life expectancy of over twenty operations. Maintenance is confined to replacement of the type 6J5 tube after approximately 5,000 hours service. Condensers and resistors are checked and matched before assembly to insure uniformity in the timing ranges of like units. UNITED CINEPHONE CORP., Torrington, Conn.



Six-in. ball-bearing grinder for repair shops and general-purpose work

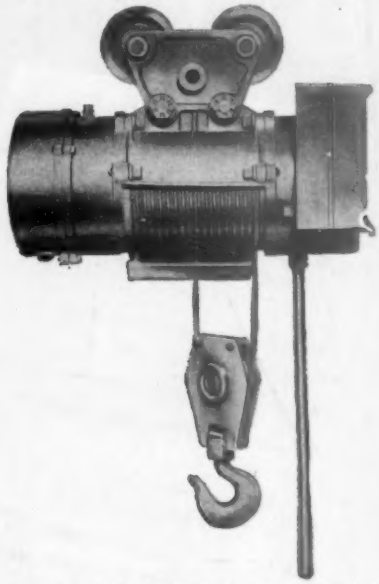
Grinder and Buffer

AN improved 6-in. grinder and buffer powered by a capacitor-type motor has been announced by BALDOR ELECTRIC CO., 4351-67 Duncan Ave., St. Louis 10. This unit (No. 60) is equipped with wide wheels (⅝ in.) and tapered bells to provide a broad clearance between the wheels and the motor frame.

☆ ☆

Electric Hoist

A NEW electric hoist, said to be half the weight of conventional models, is made in three sections, permitting easy access to any parts by the removal of about four bolts. LISBON HOIST & CRANE CO., Lisbon, O.



"Bob Cat" electric hoist is featured by light weight and small size

☆ ☆

"Hy-Speed" Grinder

A UNIVERSAL "Wyco Hy-Speed" flexible-shaft grinder has been developed in three sizes for light, medium and constant duty, in high speed grinding, burring, filing, sanding or polishing of large and small units. Compact design permits it to be set on a bench, hung from a hook or suspended from the operator's belt. Models 000-U1, 000-U2 and 00-U operate at a speed of 10,000 rpm with ⅛, 1/12 and ¼ hp universal (a-c/d-c type) motors. The shaft is covered with oil-proof synthetic rubber and innerlined with non-metallic graphite to insure true running. WYZENBEEK & STAFF, INC., 838 W. Hubbard St., Chicago 22.

BRIDGEPORT BRONZE

SAVES TIME...BREAKS BOTTLENECKS!

When a piece of equipment in a factory production line breaks, reduced output and lowered profits result. Frequently parts can be put back to work with a minimum of lost time by brazing—for example, the operating lever illustrated above was quickly repaired with Bridgeport's No. 192 low fuming bronze.

Because brazing requires only local pre-heating to a cherry red, no elaborate set-up for general heating or slow cooling is required and the brittleness caused by high temperatures is avoided. Frequently the repaired section is stronger than originally. Bridgeport's bronze welding rods have exceptional adhering properties, good tinning action, and other fine characteristics. Write for free booklet, "Bronze Welding Alloys".

"Bridgeport" BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. • Established 1865

Bronze Welding Rod A PRODUCT OF
BRIDGEPORT BRASS

PAGE *Gas* WELDING RODS

PAGE now offers two new bronze rods for oxyacetylene welding – both up to the well-known PAGE high standard of quality and uniformity. Each of these rods has many applications in maintenance and production. For specific information about these – or any other type of electrode or gas welding rod – get in touch with your PAGE distributor.

ACCO

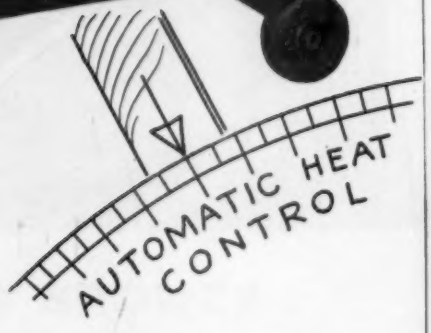
Monessen, Pa., Atlanta, Chicago, Detroit, Denver, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

WELDING
MODERN STEELS
BY
MODERN METHODS
DEMANDS
INDUCTION HEATING

60 KVA Model BH Induction Heater with Full Heat Cycle Program Control and 6 Point Recorder



FOR PRECISION
CONTROL OF
HEAT!

INDUCTION HEATING by the **SMITH DOLAN SYSTEM**
Plus The New **HEAT CYCLE PROGRAM CONTROL**
Gives all this and more.—Precision control of **PREHEATING FOR WELDING** and **NORMALIZING AFTER WELDING** is the only efficient method for joining modern alloy steels.

MODERN—SELF-OPERATING—COMPLETE!

Once the metallurgical heat-cycle for the steel has been determined, it is only necessary to set the controls, and the machine shown above will deliver this program from start to finish! In addition, recorded charts keep permanent records for duplication of results. A complete unit for efficient performance. Temperatures up to 1750° F. readily obtainable.

ELECTRIC ARC, Inc.

152-158 Jelliff Ave. Newark 8, New Jersey

Pocket-size centering head for quick, accurate calculations on any round object

Centering Head

THIS pocket-size, 9-oz tool eliminates numerous calculations when fabricating steel cylinders, laying keyways, setting tanks, measuring declivity, etc. It consists of a cast-aluminum body and a sheet-aluminum protractor dial graduated in 2½ deg and marked in 10 deg for easy reading. The punch is a ⅜ in. drill rod with a specially hardened point. Said to be "5 tools in one," the centering head can be used inside or outside of the work without moving it. HORST MEHL MFG. CO., 216 Fifth Ave., New York City 1.

☆ ☆

Precision Snap Switch

A VERSATILE precision snap switch (type 9007-A) is offered by the Square D Co. for making or breaking a circuit in small space with short movement and light pressure. This self-contained mechanism is approximately 2½ by 1⅞ in., features husky construction, mounting convenience and 550-volt ratings. SQUARE D CO., INDUSTRIAL CONTROLLER DIVISION, 4041 No. Richards Street, Milwaukee 12.

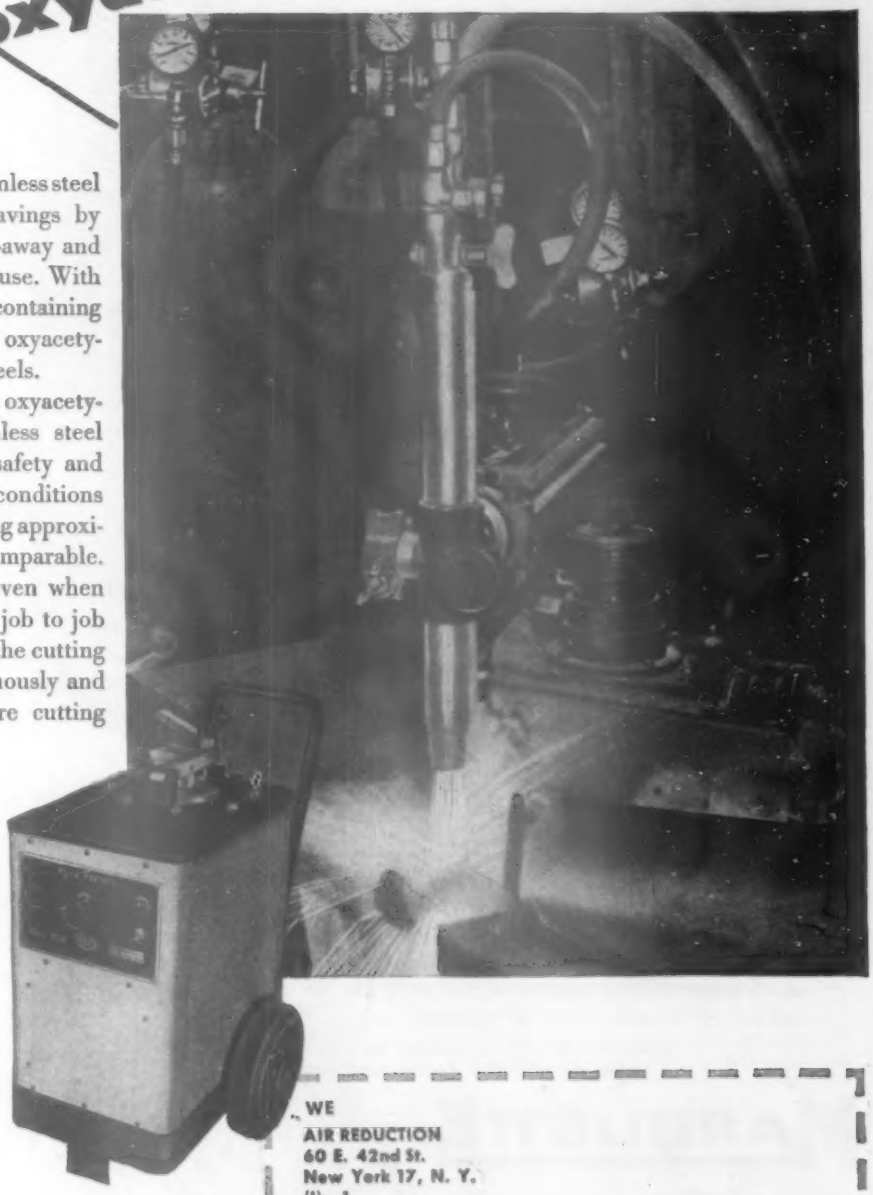
Precision snap switch of rugged construction

☆ ☆

Rust Preventative

PENNSALT "R1-50" is the name of a new rust preventative for protecting ferrous metals for short periods before they are painted, enameled or between machine operations. It consists of an inorganic salt mixture used in a water solution. This preventative requires no rinsing before painting. PENNSYLVANIA SALT MFG. CO., 1000 Widener Bldg., Philadelphia 7.

here it is! the answer to stainless steel cutting with the oxyacetylene flame



Airco's new Flux-Injection Method of stainless steel cutting points the way to important savings by eliminating the slow, laborious melting-away and mechanical processes now in common use. With the NEW Airco process, stainless steels containing alloying elements as high as 50% can be oxyacetylene flame cut as readily as ordinary steels.

Designed for use with standard Airco oxyacetylene equipment, this new Airco stainless steel cutting technique keynotes simplicity, safety and economy of operation. In fact, operating conditions and instructions for stainless steel cutting approximate mild steel, and "cut-speed" is comparable.

The Flux Feeder Unit is portable, even when fully charged, so rapid movement from job to job is assured. The Unit feeds the flux into the cutting oxygen stream. Thus, the flux is continuously and evenly dispersed throughout the entire cutting operation.

An explanatory article — "Flux-Injection Method Brings Economies of Oxyacetylene Flame Cutting to Stainless Steels" — will be available shortly. Fill in and mail the coupon for your copy. Air Reduction, General Offices, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, General Offices, Houston 1, Texas. Represented internationally by Airco Export Corporation.

AIRCO

AIR REDUCTION

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ORIGINATORS OF MODERN OXYACETYLENE AND ELECTRIC ARC METHODS FOR METAL FABRICATION

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AIR REDUCTION
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New York 17, N. Y.
(I)—1

Please send me a copy of article: "Flux-Injection Method Brings Economies of Oxyacetylene Flame Cutting to Stainless Steels"

Name_____

Firm_____

Address_____

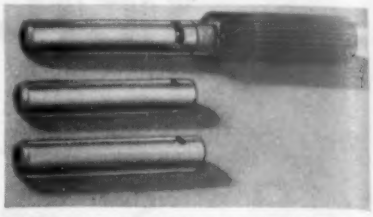
City_____ Zone____ State_____

Phosphide-Alloy-Rods

"MACOLOY" is the trade name of a new series of patented phosphide-alloy welding and brazing rods. The non-ferrous alloys (copper base) have high corrosion-resistant properties, including resistance to many acids, and may be used for surfacing, brazing and joining of ferrous and non-ferrous alloys and dissimilar metals by gas, metal-arc and carbon-arc methods. These alloys are made in three brand types: "E", "F" and "G", having melting temperatures of 1,150, 1,180 and 1,600-1,900 F respectively. Of these three types, "F", a copper-tin antimony-phosphorus alloy, is well adapted to the brazing of a wide range of metals and alloys including cast iron, steel, stainless steel, brass, bronze, copper, Monel, etc. This rod is made in 14-in. lengths and in ⅛, 5/32, 3/16 and ¼ in. diameters. The alloy is also available in powder form (60 mesh) and for high-frequency and furnace methods of brazing.

Ferrous-based phosphide-alloy hard-facing rods are available in five different types, "A," "B," "B6," "C" and "D," with Rockwell C hardnesses of 30-40, 50-69, 60-69 and 30-69. Type "C" contains iron, chromium, copper, nickel and phosphorus and is suitable for hard-facing parts subject to extreme abrasion and corrosion such as pumps, valve seats, valve plugs, cam surfaces, etc. This rod has a melting point of 1,900-1,950 F and is available in $\frac{3}{32}$, $\frac{1}{16}$ and ¼ in. diameters. It produces a non-galling surface of permanent hardness not affected by heat treatment, claims manufacturer. It can be applied by arc welding, using reverse polarity and a low current setting. McCAULEY ALLOY SALES CO., 407 S. Dearborn St., Chicago 5.

☆ ☆



Air-acetylene tips for any standard torch tip

Tip Attachments

"ACET-a-Tips" are attachable to a standard oxy-acetylene welding torch in order to convert it to soldering, tinning and light brazing with an air-acetylene flame, The complete set includes a base, fitted with a 2-in. length of heavy-duty two-ply hose, and three precision-machined brass tips of different sizes. The hose is forced over the welding torch tip to provide quick attachment. Acetylene pressure is then set at approximately 5 psi, and the flame is adjusted by the torch valve. ACET-A-TIP CO., 5069 W. Madison St., Chicago 44.

☆ ☆

Asbestos Gloves and Mittens

THIS new line of asbestos gloves and mittens has a specially designed thumb or leather reinforcement that completely covers the thumb at the points of hardest wear. This reinforcement helps to prevent the thumb seam from ripping open when metals with sharp edges are handled. Gloves and mittens are available in any lengths with or without lining, and seams are double sewn. SAFETY CLOTHING AND EQUIPMENT CO., 7016 Euclid Ave., Cleveland 3.

"Gardwell" asbestos gloves and mittens of leather reinforcement for handling hot metals

☆ ☆

Hot-Cathode Thyratron

THIS electronic relay for control circuits utilizes a new principle—the hot-cathode thyratron. Principle applications are in photo-cell circuits for direct controlling actuation of motors, valves, alarms, etc. AUTOMATIC TEMPERATURE CONTROL CO., 34 E. Logan St., Philadelphia 44.

Marquette's outstanding new transformer design gives you "Instant Arc Striking" thru the entire welding range . . . *without* the use of high frequency or booster gadgets.

Welding on light gauge sheet metal is smoother and faster because it's so easy to strike and hold the arc. On heavy welding jobs, the transformer automatically controls the arc to reduce spatter.

Model 262 C has built-in Capacitor for High Power Factor. Generous use of aluminum alloys increases transformer efficiency. Telnic Bronze plugs and sockets double current carrying capacity. Models: 262 C and 262, 20-275 amps.; 261 C and 261, 20-200 amps. Write for literature.

MARQUETTE WELDING EQUIPMENT SOLD EXCLUSIVELY
THRU THE NATION'S LEADING DISTRIBUTORS

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REGISTERED U.S. PAT. OFFICE
Welding
EQUIPMENT
A.C. ARC WELDERS · ELECTRODES
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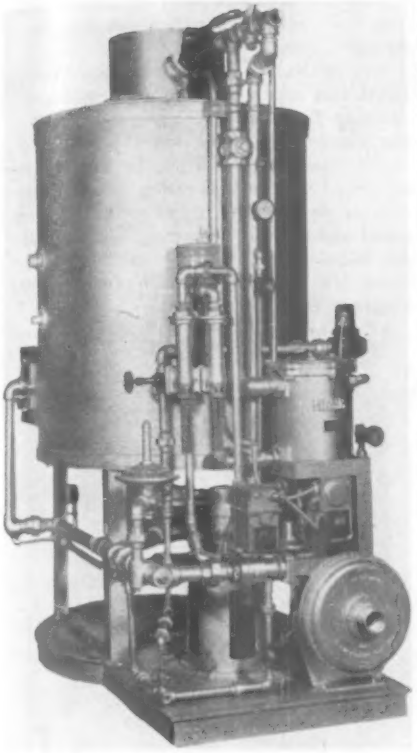
ACETYLENE GENERATORS · ACCESSORIES
MARQUETTE MFG. CO. INC.
MINNEAPOLIS 14, MINN.



"Hyen" hydryzing generator. It produces a clean, dry gas for brazing of high-carbon steels

Controlled-Atmosphere Brazing

A NEW development in endothermic atmosphere generators is the "Hyen" hydryzing generator, a fully automatic central unit that can furnish atmosphere for a number of furnaces. Employing the refractory retort principle, it produces a clean, dry gas for the hardening, brazing or sintering of all medium and high carbon steels. LINDBERG ENGINEERING CO., 2444 W. Hubbard Street, Chicago 12.

☆ ☆

Pneumatic File and Grinder

A NEW 1-lb pneumatic file and grinder has been developed to handle wheels up to 1½ in. in diameter. This 6½ by 1½ in. tool contains a vane-type motor of ¼ horsepower ranging from 19,000 to 25,000 rpm. It maintains its speed under heavy loads and cools as it is worked. All dust and chips are blown away by the exhaust of air from ports at the chuck end of the grinder.

The double grip collet chuck permits the flexible sleeve to hold oversize and undersize shanks. The standard chuck is made for tools having a ¼-in. shank, or a flexible sleeve may be obtained for ⅛ or ⅜ in. shanks. The unit is available with either lever or button control. IDEAL INDUSTRIES, INC., 1294 Park Ave., Sycamore, Ill.

☆ ☆

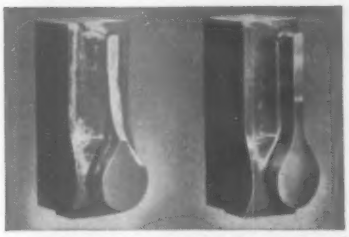
Shoe Ventilator

THE control of athlete's foot, blisters and other foot trouble is now made possible through the development of a new washable insole ventilator. This furnishes fresh air into the shoe, keeping the foot dry at all times. DALE VENT-O-SOLE, INC., 60 East 42nd St., New York City 17.

The Pioneers of Tool and Die

WELDING ELECTRODES

Can Effect Savings in Your Plant!



Die Unit repaired with Eureka Tool and Die Welding Electrodes. No heat treatment required.

Compositely Constructed Die Unit using Eureka Tool and Die Welding Electrodes. No heat treatment required.

You can save many man hours, conserve material and minimize production delays. Tool steel welding can be used profitably in any plant using tools and dies. Here's how it can be done:

1 REPAIRING DIES . . . Existing units that may fail in operation can be welded, either partially or wholly, resulting in a minimum of "down-time".

2 COMPOSITE FABRICATING . . . Die units can be compositely fabricated, when practical, by welding, resulting in numerous advantages.

3 CORRECTING DESIGN . . . Welding facilitates making changes in contour, corners or edges during die "try out" or "change over" periods.

4 RECTIFYING ERRORS . . . Welding permits the correction of errors made in tool and die manufacturing resulting in great savings.

For complete information write for technical catalog

EUREKA — TOOL STEEL ELECTRODES — FIND THE SPOT

Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

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FREE *Just clip and mail the coupon below for your free copy of our latest 40-page illustrated booklet, which will help you save many valuable man hours and minimize production delays.*

WELDING EQUIPMENT & SUPPLY CO.
223 LEIB ST.
DETROIT 7, MICHIGAN

Rush me your catalog:

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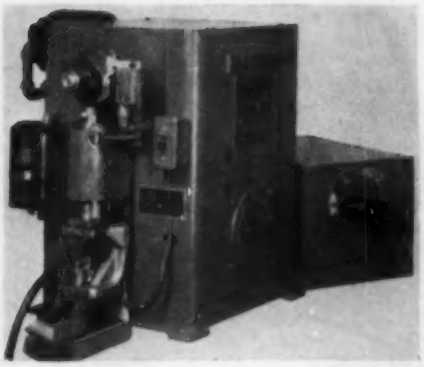
CITY_____ STATE_____



Thomson A-11 bench-type welder. Special timer permits 200 strokes per minute

Bench Welder

THE quick assembly of small parts by unskilled operators may be facilitated through a new, compact 15-kva bench-type spot welder. The unit (Model A-11) is driven by a ¼-hp motor operated through a solenoid clutch and controlled by a foot-pushbutton switch. The operator trips the clutch once to put the machine through a single welding cycle or applies steady pressure on the switch to keep the machine running constantly.

Current control is obtained by a multi-leaf, fan-type cam which controls a limit switch operating a magnetic contactor or other timing device. Heat regulation is provided by a five point regulator with a heavy copper arm and contacts to carry maximum loads. Two transformer capacities are available—10 and 15 kva.

The method of pressure application is a round cast bronze spindle, which slides in a cast-iron ram and gives a vertical motion to the upper arm. The lower arm can be raised, lowered or shifted laterally as the nature of the work requires. The pressure cam is designed to cushion the electrode travel and avoid hammering. The electrodes are water cooled and have a visible water drain. THOMSON ELECTRIC WELDER CO., 161 Pleasant St., Lynn, Mass.

☆ ☆

Magnetic-field gauge to indicate flaws in weldments, castings and other large metal parts

Magnetic Testing Unit

A NEW magnetic-field gauge for examining parts by the magnetic-particle method is announced by General Electric. This compact instrument can be used with any 115-volt, 60-cycle power source to permit standardized testing at fixed field intensities. The head consists of coils wound around a U-shaped laminated metal core mounted on a plastic handle. Pole shoes attached to the ends of the core make contact with the piece being tested, and the instrument scale is calibrated in field units related to the magnetic-field strength.

In testing for flaws, a magnetic field is first set up in the part. Magnetic particles are then distributed over the surface, and these line up along any crack or flaw. The new instrument assures a magnetic field sufficiently strong to bring out the particle pattern so that defects of the same size will give similar indications. GENERAL ELECTRIC Co., Schnectady 5, N. Y.

☆ ☆

Detergent for Steam Cleaning

A HIGH-SPEED detergent, Oakite composition No. 92, is offered for use in modern steam-cleaning guns and coil-type steam generating mechanisms. It may be used for such jobs as cleaning machinery and equipment parts for repair and overhaul; preparing equipment surfaces for repainting; cleaning equipment too large for tank immersion. OAKITE PRODUCTS, INC., 57 Thames St., New York City 6.

SAVE TIME USE A
CMD
WELDERS CHIPPING HAMMER
With steel or wooden handle. Light weight. Strong. Easy to use. Write for circular.
TYPES EB and FB
Models E and F can be supplied with brush as shown here. Brush can be replaced by unscrewing countersunk screw in bracket and removing.
TYPE F
Head has two chisels at right angles.
TYPE E
Head has drift and chisel.
TYPE A
Has drift and chisel. Widely used in malleable and grey iron foundries for general chipping
TYPE CB
Combines 3 tools in 1—drift, chisel and removable wire brush.
TYPE C
Same as Type CB, but without brush.
CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS

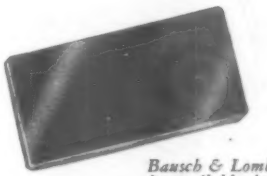
More Protection

Less Eyestrain

Increased Production

Photo—courtesy Lincoln Electric Co.

with Bausch & Lomb Welding Glass



Bausch & Lomb Welding Glass is available in a range of 12 densities, conforming to government specifications.

Real protection, but lightweight — cool and comfortable, too —Bausch & Lomb Welding Goggles with lenses of genuine B&L Welding Glass.

For reduced accident rate, increased production, improved quality, less labor turnover, lower training costs, investigate the Bausch & Lomb Industrial Vision Service. Write for "Vision in Industry" (booklet No. A-591).

A safe margin of eye protection against infra-red, ultra-violet, and glare is your first consideration in choosing a welding glass. But beyond this, look for fine optical quality, to eliminate eyestrain, and to obtain high quality production at lowered costs. Specify Bausch & Lomb Welding Glass in helmets, hand shields, and goggles. Bausch & Lomb Optical Co., 754-8 St. Paul Street, Rochester 2, New York.

BAUSCH & LOMB

ESTABLISHED 1853

KLING SHEARS

Do Many Types of Work

To Meet INDUSTRY'S PEACE TIME PRODUCTION PROGRAMS FROM NOW ON—

The latest improved shearing methods, so indispensable to all-out war-time production, will continue to be factors of speed and accuracy as industry retools for peace-time activities and expansion. Kling Rotary Shears meet many demands.

- Cut Circles
- Straight Lines
- Cut Rings of large or small radii
- Make Flanges
- Joggles and Offsets
- Cut Odd Shapes
- Bevels, and angle
- Reverse Curves
- Beads, and U's
- Cut Holes, without cutting from edges

KLING Rotary Shears are built for endurance and long-time service. Moreover, skilled labor is not required in their operation.

INVESTIGATE: WRITE TODAY FOR BOOKLET No. 245

Kling Bros. Engineering Works

1319-WE NORTH KOSTNER AVENUE • CHICAGO 51, ILLINOIS

The Profitable Way of Clamping Work for Welding

The Simplex Util-A-Tool makes a fast, easy task of clamping and holding parts for welding. Ample holding power and safety are assured by its capacity of 10 tons. Increases profits by saving time and labor. Also pushes, pulls, spreads and lifts. Write for Bulletin P&P 45.

Simplex
LEVER SCREW - HYDRAULIC
Jacks

Templeton, Kenly & Co.
Chicago (44), Illinois
Better, Safer Jacks Since 1899

Your **WELDING JOBS** Are Done

FASTER EASIER BETTER

when you use...

Mid-States METAL
ZIPPER

Do your welding jobs faster, easier, better and make more money . . . with Mid-States Metal ZIPPER, world's finest arc welder! Packed with exclusive features! Extremely easy to operate! Outperforms anything in the welding field, yet costs no more. Get the most for your welder dollar . . . get a Metal ZIPPER!

See your jobber or write for complete details, now!

Mid-States EQUIPMENT CORP.

2429 SOUTH MICHIGAN AVENUE, CHICAGO 16, ILLINOIS

The RIGHT FLUX for the JOB

FLUXINE No. 2 for brazing and bronze welding—copper, copper alloys, malleable iron and steel.

FLUXINE No. 5 for gas welding steel with base rods.

FLUXINE No. 6 . . . non-glaring . . . for bronze bonding—cast and gray iron with bronze and nickel alloy rods.

FLUXINE No. 18 for gas and atomic hydrogen welding of stainless steels and inconel.

FLUXINE No. 41 used with high-melting silver solders on copper and its alloys and on steel.

FLUXINE No. 42 used with Westinghouse Phos-Copper rods and low-melting silver solders on copper and its alloys.

FLUXINE No. 43 . . . non-glaring . . . used whenever low-melting silver solders are specified. No injurious fumes.

Wherever a flux is required "FLUXINE" Fluxes will do it better and more economically. Write us on company letterhead for sample stating your flux problem. Address Dept. G.

Better jobbers everywhere carry the "FLUXINE" line.

KREMBS & COMPANY

Est. 1875

669 West Ohio Street, Chicago 10, Ill.

FLUXINE

TRADE MARK REGISTERED U. S. PAT. OFF.

Short Circuit Currents and KVA Demands of Standard-Size Resistance Welders

Data based on available information and do not cover all makes of welders. Individual designs will vary from the figures given below. (±10% variation in current permitted.)

Short-circuit condition is not a welding condition. Reduced current during welding, as well as the usual adjustment of throat depth and horn spacing, will reduce kva demand.

Size	Rocker-Arm Welders: 8" horn spacing—Shorted by means of a copper rod the same diameter as the electrode holders clamped between the holders.				Press Type Spot Welders: 8" horn spacing—Shorted by means of a copper rod the same diameter as the electrode holders clamped between the holders.				Press Type Projection Welders: 8" platen spacing—Shorted by means of a 3" diameter 8" long copper bar, machined flat on the ends and placed at center of platens.				Seam Welders: Shorted with maximum size electrodes. Electrodes brought together under pressure and flooded with cooling water during short-circuit test. The electrodes may be stationary or rotating during the test.			
	KVA Rating 50% Duty Cycle	Throat Depth	Short-circuit Current	KVA Demand	KVA Rating 50% Duty Cycle	Throat Depth	Short-circuit Current	KVA Demand	KVA Rating 50% Duty Cycle	Throat Depth	Short-circuit Current	KVA Demand	KVA Rating 50% Duty Cycle	Throat Depth	Short-circuit Current	KVA Demand
1	15	12	10,000	35	30	18	19,000	100	30	12	22,000	120	50	18	22,000	120
	15	18	9,000	40	30	24	15,000	80	30	18	18,000	90	50	24	19,000	120
	15	24	8,000	45	30	36	15,000	90	30	30	18,000	110	50	30	22,000	140
					50	18	23,000	150	50	12	28,000	180	75	18	27,000	180
					50	24	19,000	120	50	18	23,000	147	75	24	23,000	150
					50	36	19,000	150	50	30	23,000	180	75	30	27,000	200
					75	18	27,000	230	75	12	37,000	310				
					75	24	23,000	190	75	18	29,000	240				
					75	36	23,000	220	75	30	29,000	270				
2	30	12	19,000	110	100	18	31,000	250	100	12	46,000	370	100	18	31,000	230
	30	24	15,000	90	100	24	27,000	220	100	18	37,000	300	100	30	31,000	260
	30	30	13,000	70	100	36	27,000	240	100	30	37,000	330	100	42	26,000	220
					150	18	38,000	150	150	12	60,000	620	150	18	28,000	350
					150	24	34,000	360	150	18	49,000	510	150	30	38,000	380
					150	36	34,000	410	150	30	49,000	600	150	42	32,000	320
													200	18	43,000	440
													200	30	43,000	500
													200	42	36,000	420
3	50	12	25 000	160	150	18	38,000	370	150	12	60,000	590	250	24	43,000	620
	50	24	20,000	150	150	24	34,000	330	150	18	49,000	480	250	36	41,000	490
	50	36	18,000	150	150	36	34,000	390	150	30	49,000	560	250	48	35,000	440
					250	18	50,000	680	250	12	80,000	1,100	400	24	54,000	830
					250	24	45,000	620	250	18	65,000	890	400	36	52,000	940
					250	36	45,000	700	250	30	65,000	1,030	400	48	45,000	820
4					300	18	56,000	750	300	12	88,000	1,200				
					300	24	50,000	670	300	18	73,000	990				
					300	36	50,000	890	300	30	73,000	1,300				

Courtesy, General Electric Co.

Bulk-cement trailer tank of Mayari R steel. Mayari R was specified to save deadweight and to withstand road vibration.

Your present equipment can work this high-tensile steel

In selecting a high-tensile steel, you want one that can be worked readily, using your present shop equipment and methods.

Mayari* R, Bethlehem's low-alloy, high-strength steel, can be cold-formed, hot-formed, machined, flame-cut, shear-cut and punched on the same equipment you use for working plain carbon steel. The working methods are similar, with only minor variations to allow for Mayari R's higher physical properties

In welding Mayari R, any of the standard electric-resistance, electric-arc, automatic-submerged-melt and gas methods may be used. It is a non-air-hardening steel and is not appreciably affected by welding temperatures. The only kind of welding not recommended for this steel is the hammer-forge method.

In hundreds of applications Mayari R's higher strength and corrosion-resistance are saving weight, increasing payload, extending useful life. It is available in sheets, strip, plates, bars, structural shapes and cold-formed sections. Write for the new catalog showing a wide range of Mayari R products.

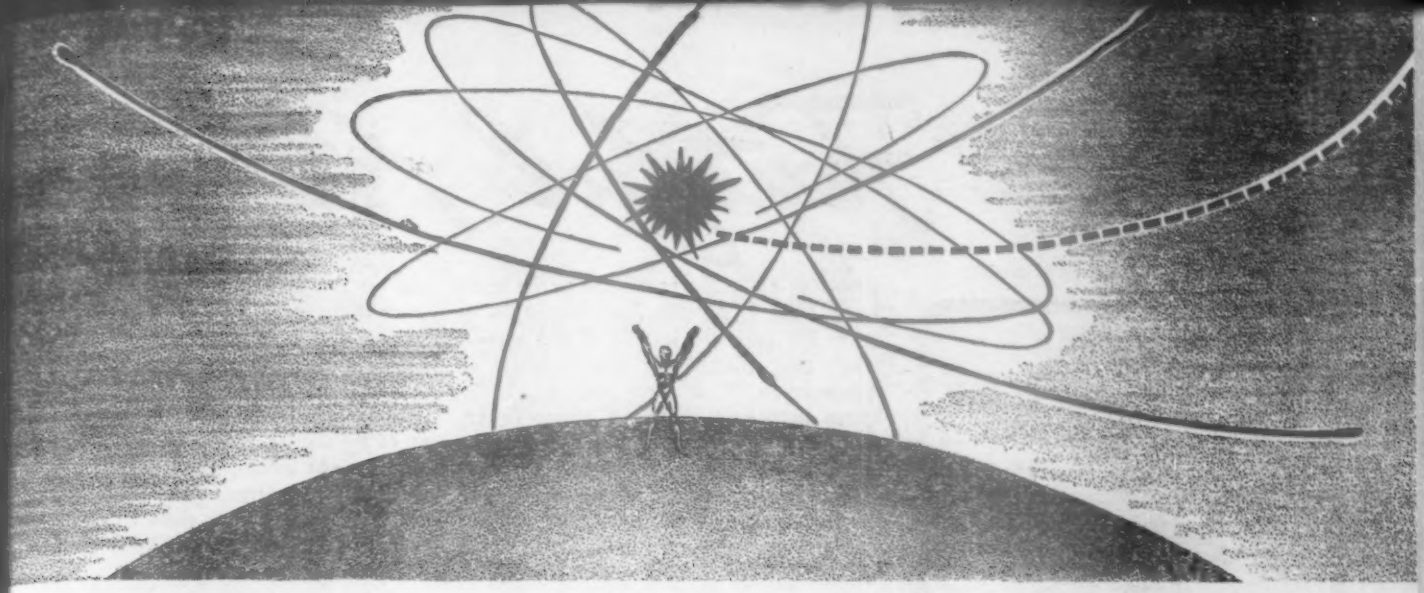
** Mayari is pronounced to rhyme with "fiery"*

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

★ BETHLEHEM STEEL ★

Mayari R *makes it lighter... stronger... longer lasting*



MAN vs ATOM—YEAR 1

WHEREIN WE SIGNALIZE THE FIRST ANNIVERSARY OF THE ATOMIC AGE, CONSIDER THE ALTERNATIVES INHERENT IN BOTH GOOD AND EVIL POTENTIALITIES OF NUCLEAR FISSION, THEN VENTURE A GLIMPSE INTO THE FUTURE

A YEAR AGO, July 16, 1945, at Alamogordo, New Mexico, man created the first atomic explosion. Most impressive events diminish in stature as they recede in time. This one grows bigger with each passing day. It truly marked the beginning of a new age.

As Year 1 of the Atomic Age ends and Year 2 begins, we are engaged in three portentous projects.

At Bikini Atoll we are detonating the fourth and, possibly, the fifth atomic explosions in the history of the world.

At Oak Ridge, Tennessee, we are building the first atomic energy plant for peaceful purposes.

Most important, in New York we and all the other United Nations are engaged in the first attempt to subject atomic energy to international control. Literally, the fate of the world hangs on this attempt.

As this introduction is written, the United Nations Atomic Energy Commission has just begun its work. People everywhere pray for its success—for their own sake, but even more for their children and for their grandchildren. If this Commission fails let everyone everywhere be warned: the world has taken a step toward destruction.

As we enter the second year of the Atomic Age, the nations of the earth are embarked on an atomic armaments race. There is no blinking that fact. We have had official notice served on us. Therefore, we must understand that unless the United Nations Commission can arrest the drift of events, we are moving toward a horrible war. The Commission must succeed.

The American delegate, Mr. Baruch, has brought to the Commission an ably thought out plan. It would internationalize nuclear science, and release for mankind the beneficent applications of atomic energy. But it would "control" atomic bombs only to the extent of giving the world brief warning of any nation's preparation to use them, so that we might have foreknowledge of disaster.

Therefore, the real and enormous task before the world becomes clear. We must end war. No other control of atomic weapons exists. If war comes, atomic weapons will be used. If they are used, our children who survive will curse their fathers. Understanding the consequences of failure, we *must* succeed.

Because we cannot succeed without knowledge, I have asked my associates at McGraw-Hill to condense into the following pages what we know at the close of Year 1 about this great new atomic force — its basic science, its possible uses and its political repercussions.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

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This Fateful Atom...

1 ORE TO U235

Only 0.7% of natural uranium is U235

LOOKING BACK twelve months to the birth of Year 1, Atomic Age, we begin to sense the majestic import of the atomic bomb that blasted the naked desert at Alamogordo, N. M., on July 16, 1945. There man first shattered atoms in an explosive *fast-chain* reaction. Then came Hiroshima and Nagasaki.

In every case the fateful atom was either uranium 235 (U235), or plutonium derived from the action of U235 on U238. Every pound of U235 atoms split in these unprecedented blasts yielded the energy of 11.4 million kilowatt-hours, or 1400 tons of coal — slightly more for plutonium.

No matter where one mines uranium ore, the purified natural uranium (Fig. 1) always contains 99.3% of the "garden" variety U238, and a mere 0.7% of the precious U235.

An atom is like our solar system. The central sun is the nucleus — a bunched mass of protons and neutrons, each weighing one unit. The planets are electrons. Each proton has one plus electrical charge — each electron an equal negative charge. There must be as many negative electron planets as positive protons in the nucleus. This is also the "number" of the atom. Neutrons have no charge, but add weight.

The atomic number of uranium is 92 because the uranium atom always has 92 nuclear protons and 92 electron planets. The isotopes U238 and U235 differ only in the number of neutrons; U238 has 146 neutrons, and weighs 92 + 146 = 238 units. U235 has 143 neutrons, and weighs 92 + 143 = 235 units.

Ordinary chemical reactions, such as TNT explosions, release only a fraction of the modest energy of the whirling electrons in the outer atom. Nuclear reactions unlock the immensely greater energies which bind together the nucleus.

Even the gentle tap of a slow-moving neutron bullet will split the atom of U235 or of man-made plutonium into two medium-weight atoms, yielding also one to three spare neutrons plus energy. Thus these *fissionable* materials supply both their own bullets and a highly sensitive lot of high-explosive targets — a perfect setup for a *chain reaction* (Fig. 2).

Chain reactions work like chain letters. Neutrons from one nuclear explosion hit and explode other nuclei. But, since atoms are mostly open spaces a chain started in a small block of U235 or plutonium quickly dies out because most of the released neutrons escape from the block.

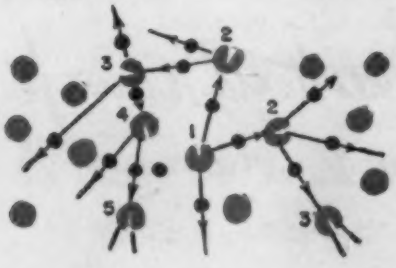
The bigger the block, the smaller will be the percentage of escaping neutrons, and the more left to split other nuclei. When the block is rapidly built up beyond a certain secret size the fragments of 1000 nuclear fissions split many more than 1000 additional nuclei. Then fissions multiply geometrically, and the block disintegrates with explosive speed and violence — as in a bomb (Fig. 3).

This bomb explosion is a fast-neutron chain. For economy and ease of control, uranium piles for the gradual release of nuclear energy for commercial purposes will normally use a lean fuel — that is U235 or plutonium diluted with U238, thorium or other less costly materials.

To maintain a chain reaction such piles must be large and artificially stimulated by using carbon blocks or some other *moderator* (Fig. 4) to slow many of the neutrons. Slow neutrons make more hits than fast neutrons because there is more time for them to be swerved from a straight path by the attraction of nearby nuclei, as shown below.

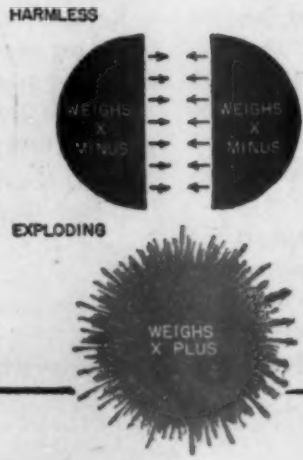
2 CHAIN REACTION

Fragments from earlier nuclear explosions smash other nuclei



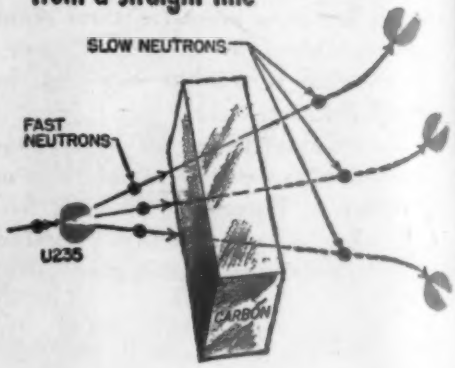
3 WHY BOMB EXPLODES

When block of rapidly assembled U235 passes secret critical size it explodes spontaneously



4 SLOW NEUTRONS MAKE MORE HITS

A slow neutron is more easily swerved from a straight line



...can Serve Man...

THE FATEFUL U235 ATOM can serve man as a new, compact source of heat energy for power generation, comfort heating or industrial processing. Peacetime applications of atomic energy will use dilute U235 or plutonium as a "fuel," mixed with carbon or some other moderator to slow some of the neutrons and thus keep the chain reaction going.

The diluting agent may be either U238 or thorium, or both. These will do double duty, because neutron bullets convert U238 into the energy-yielding plutonium, and thorium into U233, which may prove equally serviceable.

Thus the commercial piles of the future will "burn" U235 to make other atomic fuels, plutonium and possibly U233, which in turn will deliver heat energy to the pile. In that way it will be possible to get from the pile far more heat than the equivalent of 1400 tons of coal for each pound of U235 split. This highly attractive prospect will speed the day when nuclear energy can compete with coal.

While already mechanically obsolete, the piles making plutonium for bombs at Hanford, Wash. (Fig. 1) reveal the basic principle on which future piles for power and heat will operate. The heat now wasted in vast quantities will be put to work. The plutonium, now removed for bomb manufacture, will be returned to the pile (or left in) as supplementary fuel.

ATOMIC POWER

The possible everyday applications of nuclear heat pictured in Fig. 2 have been recognized from the very first day of the Atomic Age. Year 2 will see the building of the world's first atomic power plant (a pilot plant) at Oak Ridge, Tenn.

Beyond question such installations will produce power, but it may be years or decades before they prove economical. To compete with conventional plants the piles must first be redesigned to run at temperatures high enough for good power-plant efficiency. Also the techniques of operating piles by remote control through the heavy radiation screens must be radically streamlined.

The Hanford piles run on natural uranium containing only 0.7% of U235. The typical commercial atomic power plant of the future will use more than 0.7% of U235 or plutonium, but less than 50%. This will avoid both the low efficiency of the too-lean mixture and the excessive fuel cost of the rich mixture. It will permit piles of moderate size and take maximum advantage of U238 and thorium as potential sources of plutonium and U233.

One should not expect U235 to replace coal generally in this generation, although a few central power stations and ships will try it out before Year 10 of the Atomic Age. Plants far from traditional sources of fuels may turn much sooner to uranium and thorium as concentrated heat sources, that may easily be transported even to remote corners of the earth.

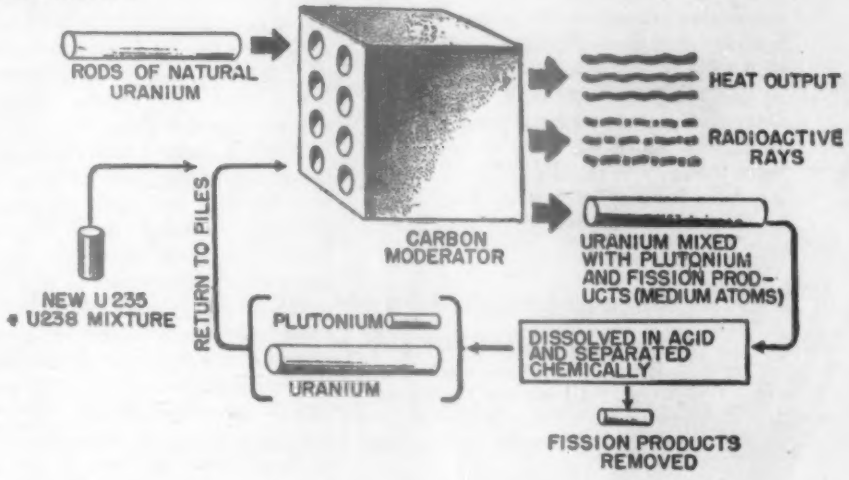
Atomic power, in forms now known, is impracticable for automobiles and small airplanes, because of the large initial investment in uranium and the need to carry 50 tons of shielding to protect riders and pedestrians against the deadly radioactivity accompanying nuclear fission.

RADIOACTIVE ISOTOPES

More immediately important than the heat and power applications of nuclear energy are the services that the radioactive byproducts of pile operation can render. Because these materials act chemically like their ordinary non-radioactive cousins, but can be followed and detected easily, they are expected to play tremendously vital parts in medicine and biology. For more details, see the last page of this section.

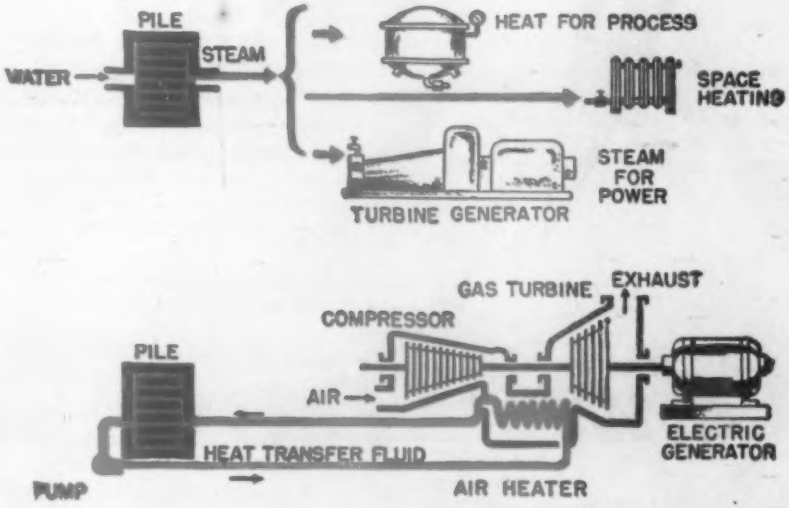
1 SLOW-NEUTRON PILE

Can make plutonium for bombs—or heat for power, process and comfort



2 PRACTICAL APPLICATIONS

Include steam for turbines, process and comfort heating—also heat for gas turbines



or Destroy him . . .

A single improved atomic bomb can devastate ten square miles of city

URANIUM 235 and plutonium are now man's slaves. They will build or destroy as he orders. Man dreads this vast force only because he distrusts himself. War is proof that man in the mass has never achieved self-control. He has always sought better weapons; yet the perfect weapon now brings him no satisfaction for he sees in the atom bomb his own destruction as well as that of his enemy.

The ultimate benefits of nuclear energy may well surpass its present terrors, but the terrors are here now in awful dimension, and man must face them. He must pay this price for unlocking the wealth of the inner atom.

ATOMIC BOMB

This page, then, is about the atomic bomb. Nothing will be said here that is not either a certified scientific fact or a conclusion shared by the majority of the leading scientists, engineers and statesmen who have studied the matter.

As already explained, an explosive nuclear chain reaction spontaneously sweeps through a block of U235 or plutonium when the block is rapidly enlarged beyond a certain "critical" weight X. That weight is still a military secret; the official Smyth report vaguely suggests that it is more than 4 lb and less than 200 lb. Each piece of U235 in the dormant bomb must weigh less than X. At the desired instant of explosion the bomb mechanism assembles these pieces rapidly into a single piece considerably heavier than X.

The explosion itself drives the U235 pieces apart, thereby quenching the atomic conflagration before all the atoms are split, so the bomb efficiency is far less than 100%. For each pound of U235 (or plutonium) atoms actually split, the bomb releases the energy of 1400 tons of coal.

This explosion is mainly ordinary heat at work in unprecedented concentration. Bomb metals become incandescent vapor millions of degrees hot. This, and the enveloping sphere of glowing air, radiate a blinding flash that chars human flesh at half a mile and blisters at over a mile. There is a destructive shock wave (sound) and a second-long hurricane of unimaginable force — the outrushing of the expanding heated air. Deadly neutrons and gamma rays speed out from the bomb.

A single atomic bomb killed about 100,000 at Hiroshima. Fewer died at Nagasaki only because the circle of potential destruction included much vacant land. Bombs ten times more powerful can be made by the thousands in any major industrial country with the plants and the know-how. One bomb could saturate Minneapolis or downtown Manhattan.

Many experts estimate that a complete set of American atomic "secrets" and blueprints might save a foreign power two to three years at best in its race for atomic arms. With no help at all from us, any advanced industrial nation can, in five to ten years, acquire the raw materials, the plants, the know-how and enough bombs to knock out the big cities of any other country overnight. In Year 2 of the Atomic Age this arms race is already on.

It will not fail for lack of raw materials; every country has lean ores worth working for bombs.

THE CHEAPEST DEATH

Cost need not deter, for the atomic bomb is by far the cheapest method of destruction ever devised. General H. H. Arnold estimates that atomic bombs can be manufactured *and delivered* for less than $50 000 per square mile of destruction.

Don't be misled by the two billion d lars America spent on a project t dropped only two bombs on the ene New plants can be built at a fraction wartime cost, and the investment spr over thousands of bombs, not just tw

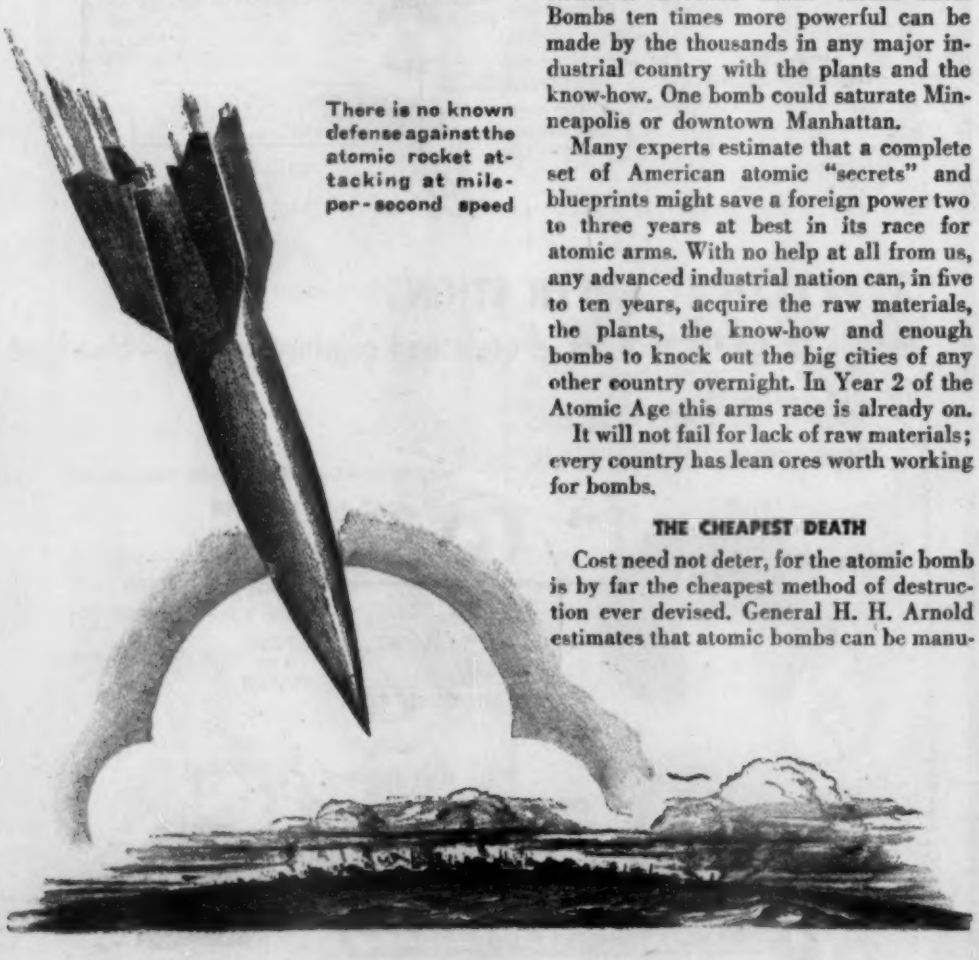
NO DEFENSE

So the bombs can be made in am quantity and paid for, but can they delivered? The answer is: "Yes; by t time the bombs are ready they can be livered anywhere and overnight." If t defenses of the target country are we piloted planes can get through in am number. Ten percent would be enough.

For more effective delivery radio-steer pilotless planes and rockets can carry t atom bombs faster than sound. Such wea ons will be almost untouchable by eith antiaircraft artillery or manflown fighte

Greatest threat of all will be the tran oceanic rockets. The German V-2 rock which never once was stopped by Britain defenders, points one way. It needs on transatlantic range (with atomic propul sion) and an atomic bomb in the nos Forty-six feet long, loaded with 7500 l of alcohol fuel and 11,000 lb of liqui oxygen, the V-2 of World War II rose 6 miles in the air and arced 200 miles in fiv minutes to deposit one ton of TNT i London.

Seeing so many strange things come t pass, the man in the street cannot disti guish between possible miracles and th impossible variety. From the very start o the Atomic Age he has been hoping for a "ray" that will explode the atom bomb fa off. Competent scientists and engineers say that cannot be.



There is no known defense against the atomic rocket attacking at mile-per-second speed

The only way to bring down a 3500-mile-per-hour rocket at a safe distance is to chase it with your own 4000-mph rocket. You can't win at this game often enough to establish ironclad protection.

The only specific defense against the atomic rocket known in Year 2 of the Atomic Age is to disperse all cities and put key industries underground. This would be very costly in time, money and national morale.

MORE AND BETTER BOMBS?

Some will ask whether the U.S., as the most powerful industrial nation, could not build more and better bombs and carriers than any other nation. Probably yes, but there is still no real security. If the "weak" opponent has enough atomic weapons to destroy us once, what advantage is there in being able to destroy him twice?

Shooting first could protect us now, but not after the world is atomically armed. If we were to destroy the enemy's cities, we would probably miss his well-concealed and protected bomb magazines and rocket launchers. A few minutes later he could return the atomic fire. In brutal simplicity, that is the picture of future atomic war. Everybody loses.

At this point one grasps at another straw: "If everybody is to lose who would be so foolish as to start an atomic war? And didn't the Germans refrain from using gas for a similar reason?" Possibly yes. It *may* work that way. But in a world atomically armed to the teeth some nervous finger *may* pull the fatal trigger.

ONLY ONE WAY OUT

Throughout history each new offensive weapon has called out its appropriate defense. But now the offense leaps centuries ahead in a single bound and the defense lies almost helpless everywhere, unless some technical protection, unknown as Year 2 begins, can be devised.

The situation is extremely dangerous. There is no clear way out except through some sort of international action first to stop the atomic arms race and, before it is too late, to hobble war itself.

Can it be done? Perhaps not, but there is no alternative except atomic chaos.

...so he faces the Atomic Dilemma.

THE NUMBERED statements that follow in somewhat logical pattern are too fateful to be accepted on anybody's say-so. Every reader should test them in the light of his own information and understanding.

The points below sum up the conclusions of the previous article — and these in turn reflect a great mass of thought and discussion among leading scientists, engineers and statesmen close to the problem. To an amazing degree they concur on both facts and conclusions. For authoritative statements of their line of thought, in detail not possible here, the reader should see the recent book, *One World or None.*

THE DILEMMA

Nations must either face the probability of an atomic World War III, which would surely be the most deadly in history . . .

***Or,* the experts propose, yield both atomic weapons and war potential to international authority backed by superior force.**

What the Experts Say

1. In five to ten years any major industrial nation can make enough atom bombs to destroy all the major cities of any other country overnight.

2. This assumes no "secret" information or other help from us.

3. The necessary uranium ores will be at hand.

4. The cost will not be too high.

5. The bombs produced can then be carried thousands of miles by bombers, or by atomically powered guided missiles moving faster than sound.

6. There will probably be no effective military defense against such weapons.

7. Dispersing cities, and putting key industries deep underground, will give some protection if accomplished in time, but at incredible cost in money and human discomfort.

8. In a world atomically armed, nations can probably protect their bomb stocks and rocket launchers from enemy assault.

9. If so, nation A can destroy the cities of any other nation B, after which B's rockets will destroy the cities of A. Shooting first will not win an atomic war.

10. This knowledge may not restrain the trigger finger of a suspicious power.

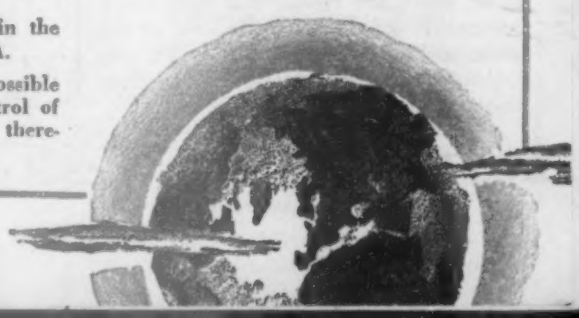
11. Having more and better atomic weapons than the other fellow won't help much if he has enough to destroy us. No use to kill a man twice or rebomb urban ruins.

12. Every nation is vulnerable in the Atomic Age, including the U. S. A.

13. National security will be impossible without (first) international control of atomic arms and (not too long thereafter) international control of all war potential, both backed by superior physical power.

14. If action to this end is long delayed, it may become impossible to halt the atomic arms race already started.

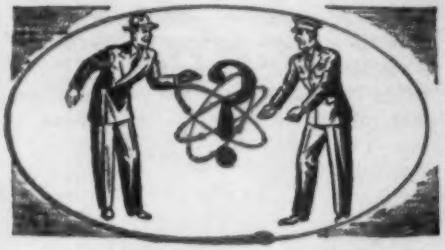
15. At best, the necessary degree of international control, with some real delegation of national sovereignty, will be a revolution in human affairs. It may prove to be humanly unobtainable at this time. If so, men and women everywhere must face the probability of an atomic third world war—by far the most destructive in all history.



In this atomic age no nation can be safe through its own unaided might

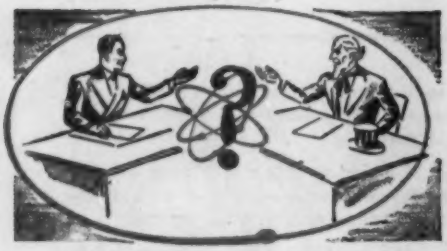
...and the Great Debate unfolds

ATOM YEAR 1 has probably been marked by more debate on a single subject than any other twelve months in the world's history. Social, economic and political as well as purely technical issues have been pressing for realistic solution. Let us look at these issues and see where we stand:



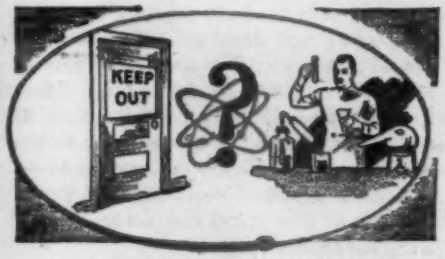
CIVILIAN VS. MILITARY

Because the atomic bomb is the world's greatest weapon, the armed forces would like to control it. But because atomic energy can also be used for peaceful, beneficial purposes, civilian control seems equally essential. These conflicting viewpoints had their strong proponents before the Congress which finally reached a fairly satisfactory compromise in the Atomic Energy Bill of 1946, setting up a competent civil board with which the armed forces will have continuing liaison. As we go to press, just before Year 2 of the Atomic Age begins, this bill has passed the Senate, but there is still a question how rapidly it will be enacted into law.



PRIVATE VS. PUBLIC

Atomic energy is "too big" and "too hot" to be handled privately. It must be nationalized and internationalized. The questions are *how* and *to what extent.* Fortunately, as the "boxes" on these pages show, there are means that may attain reasonable safety against misuse of the atom, and still do so without public control of many "non-dangerous" applications.



SECRECY VS. FREE SCIENCE

Throughout the first year of the Atomic Age hot debate has raged around "keeping the secret of the bomb." To prevent potential enemies from making atom bombs some have urged a complete blackout of all phases of atomic energy — even of the scientific fundamentals of nuclear physics. Others have sought immediate and complete disclosure of all bomb "secrets," both scientific and technological. These have held that such information cannot be effectively hidden, that secrecy blocks progress and breeds wars.

A year of debate has brought the great mass of vocal opinion to this middle ground: (1) Ease restrictions on the exchange of basic physical knowledge. (2) Release for industry's benefit many of the devices and methods developed for the bomb project. (3) Hold tight to specialized information on atomic bombs and bomb-material production until international safeguards are fully operative.

DOMESTIC CONTROL AS PLANNED IN THE ATOMIC ENERGY BILL OF 1946

McMahon Committee Bill contains the following provisions.

Policy. Declares it the policy of the U. S. to develop and utilize atomic energy to improve the public welfare, increase living standards, strengthen competitive enterprise and promote world peace.

Organization. Establishes the Atomic Energy Commission (AEC) of five administrators to direct four divisions on research, production, engineering, and military applications—to work in liaison with three committees from (1) the armed forces, (2) outstanding civilians, and (3) joint Congressional representatives.

Production. AEC to own and operate (under management contracts with industry if deemed desirable) all facilities for the production of fissionable materials, such products to be distributed with their radioactive byproducts under license for private industrial and medical research.

Military Application. AEC to engage in development work and produce atomic bombs as directed by the President, to be delivered only on his order to the Armed Forces.

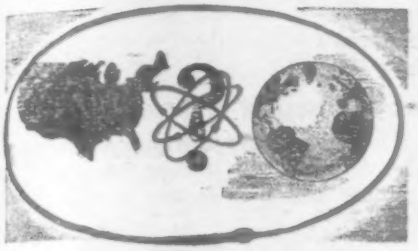
Industrial Utilization. Permits AEC to conduct research, design and manufacture equipment for atomic-energy utilization, license its use, produce and sell power obtained as a byproduct in the production of fissionable materials. Directs AEC to give widest safe scope to private initiative.

Control of Information. AEC to enforce a ban on the dissemination of restricted data that might be used to injure the U. S. or secure advantage to a foreign nation, yet to provide leeway for ultimately relaxing restrictions as future conditions warrant.

Patents and Inventions. No private patents permitted for production of fissionable materials or their utilization for military weapons, but AEC will justly compensate for such inventions, when made by private citizens. Patents for non-military applications may be purchased or condemned by the AEC only when public interest is affected.

Appropriations. "Such sums as may be necessary and appropriate to carry out the purposes and provisions of the act" *plus* unexpended funds of the Manhattan Engineer District.

while Time runs out



NATIONAL VS. INTERNATIONAL

Born of nationalism, the Atomic Age began when three nations discovered a weapon that today gives them the greatest military power on earth. The prime question is: Shall the atom remain the servant of its conqueror, nationalism?

During Year 1 of the Atomic Age the Truman-Atlee-King declaration, the masterly report of the State Department's atomic consultants, and the U.S. representative on the United Nations Atomic Energy Commission, have all called for international control of atomic energy. Year 2 will start with no such control. This failure to decide and act is in part a natural result of the extreme difficulty of the problem and the obvious dangers of unwise decisions. Nations everywhere face a triple dilemma in this Atomic Year 2: the dangers of nationalism, the dangers of internationalism, the supreme danger of not being able to make any decision in time to meet the atomic bomb threat.

INTERNATIONAL CONTROL AS PROPOSED BY THE U.S. TO U.N. ATOMIC COMMISSION

Baruch statement follows constructive path laid out by Atomic Consultants in "Acheson-Lilienthal Report."

The Plan. The U.S. has proposed that all nations band together to outlaw the use of atomic energy for war and to promote and harness its development for the benefit of mankind. To this end an International Atomic Development Authority would be set up, and to it the U.S. would turn over, at various stages of its organization, all atomic bombs, know-how, raw materials, facilities, and stockpiles of fissionable material. Thus IADA eventually would supersede national authorities on some matters and supplement them on others.

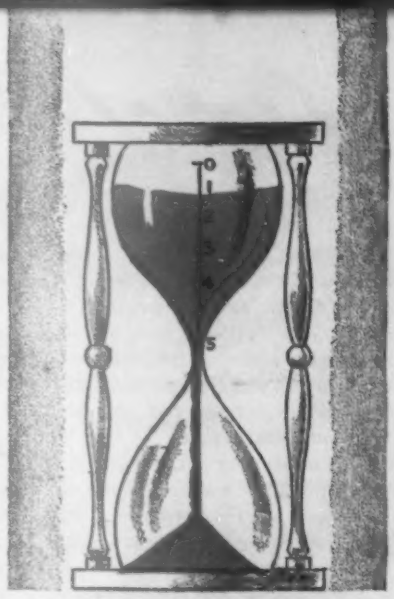
Owner and Operator. IADA would take over from national authorities or private ownership full management and control of all atomic energy matters that afford a possible threat to World security. These include:

1. Raw Materials—Supplies of uranium and thorium to be inventoried, controlled, and developed by IADA.
2. Facilities—IADA to control and operate plants producing fissionable materials and to own and control their products.
3. Research—IADA to undertake research and development on all aspects of atomic energy and to possess exclusive right of research on atomic explosives.

Private Initiative. Will have its chance to push forward the use of atomic energy for peacetime (non-dangerous) purposes. With IADA providing raw materials and carrying out necessary inspection, national and private enterprise may operate "safe" power piles, and produce and use radioactive isotopes for research, clinical and other applications. Radioactive isotopes produced by IADA also can be distributed for peacetime use.

The Mechanics of Safety. No plan is a certain guarantee against future atomic war. This plan should, however, prevent surprise attack with atomic weapons; for IADA is to buttress positive ownership or management controls with wide powers of inspection. Obviously, successful inspection rests on complete freedom of access or egress in any area.

Sanctions. At the heart of the plan lies the problem of penalty for violation—a matter for profound statecraft. To the U.S., one aspect of sanctions appears crystal clear: Here is an area where the veto right now held by the five great Powers must be redefined if it is not to be incompatible with the meaning and purpose of the proposed control.



Leading industrial nations can produce atomic bombs in five years, competent scientists announced after Hiroshima. Already one year of the precious five has been consumed in debate without international action. Soon it may be too late to check the growing momentum of the atomic arms race.

TIMETABLE—ATOM YEAR 1

1. **July 16, 1945. World's first atomic bomb detonated in New Mexico.**
2. **July 26, 1945. President Truman and Prime Minister Churchill issue Potsdam ultimatum threatening Japan's destruction if she continues.**
3. **August 6, 1945. Atomic bomb dropped on Hiroshima.**
4. **August 9, 1945. Atomic bomb hits Nagasaki.**
5. **August 11, 1945. Army releases Smyth Report on "Atomic Energy for Military Purposes."**
6. **August 14, 1945. Japan accepts terms of Potsdam declaration.**
7. **November 15, 1945. Truman-Atlee-King issue declaration of intention and procedures looking toward international control of atomic energy by United Nations.**
8. **March 28, 1946. State Department issues Acheson-Lilienthal Report on the "International Control of Atomic Energy."**
9. **April 12, 1946. Manhattan Engineer District announces program for experimental development of atomic power.**
10. **June 1, 1946. "Atomic Energy Bill of 1946" passes Senate unanimously, is referred to House of Representatives.**
11. **June 14, 1946. First meeting of United Nations Atomic Energy Commission (Bernard Baruch as American member). Manhattan District announces availability of radioactive isotopes for research use.**
12. **July 1946. Joint Army-Navy tests of atomic bombs at Bikini.**

...but if Man Masters Atom...

IF MUTUAL DESTRUCTION by the atomic bomb can be avoided, the first century of the atomic age will bring immense advances in scientific knowledge, health and living standards. Already many prospective benefits can be outlined, but those we can neither foresee nor suspect may be even more important.

This prediction is grounded in scientific experience; the most fundamental discoveries have always been the most fruitful. The study of molecules gave us chemistry. Faraday's experiments with electricity and magnetism are the foundation stones of the great electrical industry. Can one expect any less from an understanding of the heart of every atom?

BENEFITS

Atom-splitting benefits clearly visible today fall mainly in three classes: (1) heat and power applications of the uranium piles; (2) general industrial applications of equipment and methods originally developed for the bomb project; (3) chemical, biological and medical uses of the "tagged atoms" (radioactive isotopes) now abundantly available from pile operation.

It is now evident that the energy yield of the U235 in an atomic pile can be multiplied many times by returning to (or leaving in) the pile the plutonium and possibly the U233 produced respectively from the U238 and the thorium in the pile. This is an indirect way to "burn" inexpensive U238 and thorium, and thus greatly extend the supply and reduce the cost of atomic fuels.

POWER APPLICATIONS

Although present piles run at low temperatures, it is certain that temperatures high enough for the efficient operation of steam and gas turbines will be attained. Already an experimental atomic power plant has been ordered. Atomic power for certain remote installations (say, for heating Arctic airports) may not be far off.

In five or ten years uranium piles will be driving a few experimental ships and submarines. In 20 or 30 years uranium may begin to compete widely with coal as a fuel for suitably situated large central heating and power plants. The 50-ton minimum weight of shielding rules out nuclear power for automobiles and small piloted planes.

SPECIAL USES

Some day ultra-high temperatures from splitting atoms will be used for special industrial operations on metals and other materials. Even the dread atomic bomb might easily serve peaceful ends — blasting lakes in deserts, changing the course of rivers, leveling mountains.

INDUSTRIAL BYPRODUCTS

The special industrial equipment and methods developed for the bomb project will find hundreds of important uses — mostly for purposes unrelated to atomic energy. These developments include pumps with neither seals nor leaks, leak detectors of amazing sensitivity, ultratight welding, a portable mass spectograph for quick and automatic gas analysis, new ways of handling corrosive and poisonous materials, new diffusion barriers for the separation of gases and of petroleum products.

TAGGED ATOMS

Yet more important than any of these, in the long run, will be the hundreds of radioactive isotopes now available as by-products of pile operation. Chemically indistinguishable from the ordinary forms of the elements, these isotopes serve as tagged atoms or "spies" if mixed with common stable atoms of the same species. They "fly with the flock," and can later be identified as surely as banded birds. With these amazing tools of research, the course of any element or compound may be traced through the bodies of men, animals and plants. Similarly, tagged atoms may be used in studying the course of many kinds of industrial and chemical operations.

BIOLOGY AND MEDICINE

A suspected hyperthyroid condition can be diagnosed by feeding the patient a minute measured amount of radioactive iodine. The click of a "Geiger" counter placed on the patient's neck will tell (1) what percentage of the swallowed iodine concentrates in the thyroid cells and (2) how rapidly that concentration is accomplished — giving a definite indication of the state of the gland.

In similar fashion the radioactive isotopes of hydrogen, oxygen and carbon will trace out the intricate transformations of carbohydrates and proteins in the human body. Radioactive phosphorus will explore the bones. Radioactive iron will show how and where blood cells are formed. Radioactive sodium will time the circulation of blood.

USES IN INDUSTRY

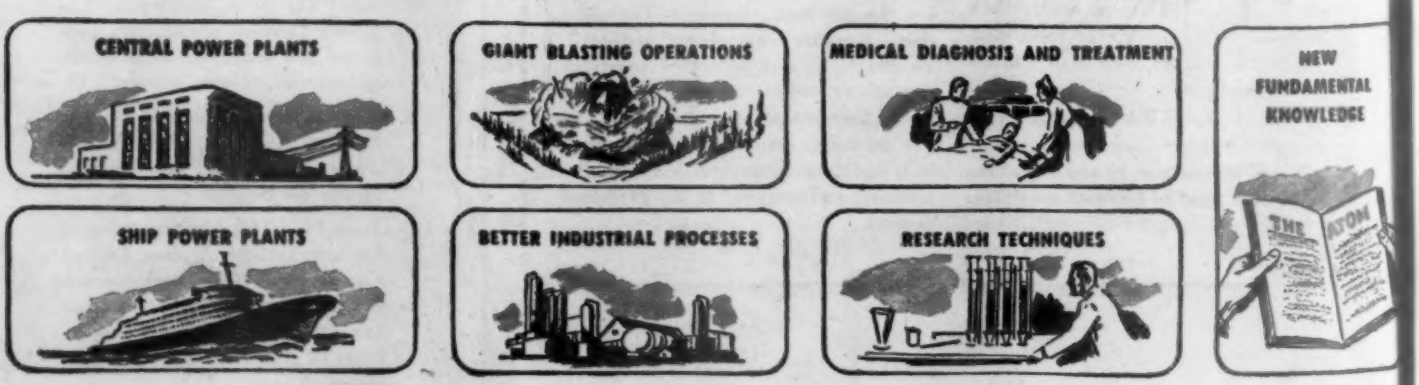
In chemistry the radioactive isotopes will speed the understanding of metallurgical and organic reactions. In industry they will measure flow, detect leaks, and do other useful work.

Meanwhile the uranium piles will be manufacturing certain radioactive isotopes that can serve as cheap but effective substitutes for high-cost medical radium.

KNOWLEDGE COMES FIRST

It is already clear that the chief benefits of atom splitting will come first as new scientific knowledge rather than as new engines and gadgets. But in the long run man's new understanding of the inner atom will enrich the whole range of human activity. This has always been the case with less fundamental discoveries in science. It can hardly be less with this most fundamental discovery.

ATOM SPLITTING WILL SERVE MAN IN:



News of the Industry

Swain Sends First A-Bomb Test Report

PHIL SWAIN, technical observer for McGraw-Hill Publishing Co., Inc., aboard the press ship *USS Appalachian*, reports that the atomic-bomb experiment of July 1 was well planned and executed. The bomb, he declares, was of normal efficiency and performed as informed opinion had predicted.

"Those who expected the impossible—trees uprooted at Bikini Island three miles away or steel melted on ships a quarter mile away—were disappointed," reported Editor Swain. "The much advertised 'hundred-million-degree heat' was confined to the bomb's center and lasted perhaps a millionth of a second. This photoflash didn't melt even the thinnest aluminum foil or appreciably warm the ships. It merely gave them a skin-deep sun burn. Top paint coats blistered. Lower coats were untouched.

"More flimsy constructions, such as thin wind breaks, funnels, topmasts and radio masts, were often bent and twisted. At one-third mile, or even less, rubber tires remained like new and exposed jeeps could have been driven away. However, many airplanes on decks at greater distances were substantially damaged by blast pressure."

Lest all this sound like belittling the Able Day bomb, Mr. Swain points out that it did immensely more damage than any other in naval history, sinking five ships and heavily damaging five others including one submarine.

The effects of pressure, like those of heat, faded rapidly with distance. "Very likely the instantaneous pressure at the center of the bomb reached millions of pounds psi," Mr. Swain concedes, "but again distance did its work. On the cruiser *Pensacola*, approximately one-third mile from the burst, the blast pressure was only 5 or 10 psi. According to my horseback estimate, this would be enough to account for the collapse of the 20 ft wide by 30 ft high (estimated) funnels of thin-gauge steel (estimated ⅛ in.). At 10 psi the total force on the projected area of one stack would be over 400 tons.

"The bomb produced about the same blast, flash and radioactivity as the one that burst over Nagasaki. But the much stronger construction of the naval targets contracted the circle of great damage from about a 3-mile diameter to about 1½ miles."

☆ ☆

Ford to Build $50,000,000 Research & Engineering Center

WITHIN the next eight years the Ford Motor Co. will spend $50,000,000 in building a Research and Engineering Center. This will comprise a primary group of eight buildings grouped around an artificial lake 800 ft long and 350 ft wide. The new research project will specifically contain an organization designed to develop new welding methods and improve existing methods and applications. Various resistance-welding processes, automatic-arc welding, manual and gas welding are to be included. Considerable instrumentation is planned to determine and interpret the results accurately for possible production application.

The project is named in honor of Henry Ford and Edsel B. Ford.

☆ ☆

Metallizing Co. Moves Eastern Office and Warehouse

METALLIZING COMPANY of AMERICA has moved its eastern office and warehouse to 431 East 75th Street, New York City 21.

View of the $50,000,000 Ford Research and Engineering Center to be erected in Dearborn, Mich.

. . . IN MODERN SCHOOL

It's a beautiful steel building, built especially for Welding instruction. Each student has his own individual welding booth and personal arc welder. Large, airy rooms for classroom instruction periods. Reference books, head shields and protective clothing issued to every student.

. . . WITH EXPERT INSTRUCTORS

The teachers are expert arc weldors who have had many years of practical arc welding experience. They keep up on modern welding techniques and pass them on to the students.

. . . UNDER THE G. I. BILL

The Hobart Trade School is fully qualified under the G.I. Bill, and service veterans are welcomed to its classes. Established years ago, the school is not a World War II offspring.

COMPLETE COURSE —

The course of instruction is complete and intensive. Welding is taught in all its phases, arc, alloy and carbon arc, acetylene and flame, helium, stud, automatic, resistance and metal spraying.

GOOD WELDORS IN DEMAND!

All over the country, manufacturers are clamoring for more arc weldors. It's one of the highest paid industrial jobs available today—send the coupon below for further details.

HOBART TRADE SCHOOL, INC.
Box U86 **Troy, Ohio**

HOBART TRADE SCHOOL, Box U86, Troy, O.
Send more details about your welding school. I've checked my status for entrance below:
☐ Veteran ☐ Non-veteran
NAME
ADDRESS
CITY STATE

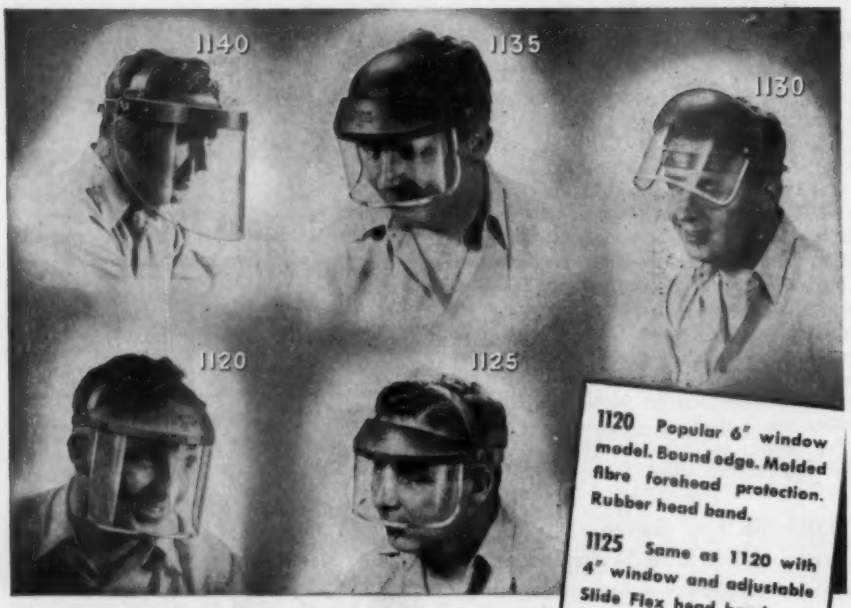
Germans Developed New Flash-Welding Techniques

MACHINES that can flash-weld steel cross-sections up to 25,000 sq mm (about 38 sq in.) were developed and used by German technicians, according to a report recently released by the Office of the Publication Board, Department of Commerce. This report is a translation of a German book published in 1936. The translation was made at the Battelle Memorial Institute, Columbus, O., and published with comments by American researchers.

The German book was written by Dr. Hans Kilger, a German engineer; and is said by American experts to be "the most complete publication on flash welding that has appeared in the literature to date." It includes systematic studies of the various steps in the flash-welding process and of their effects upon hardness, fatigue, strength, tensile strength and impact resistance. Dr. Kilger's data on the effect of temperatures and upset pressures on the quality of flash-welded joints, as well as his methods of obtaining these data, are said to be particularly instructive and should provide a basis for further research along these lines.

Orders for this report (PB-20181) should be addressed to the Office of the Publication Board, Department of Commerce, Washington 25, D. C. and accompanied by check or money order (photostat, $1; microfilm, $2) payable to the Treasurer of the United States.

DOCKSON FACE SHIELDS



1120 Popular 6" window model. Bound edge. Molded fibre forehead protection. Rubber head band.

1125 Same as 1120 with 4" window and adjustable Slide Flex head band.

1130 4" metal band window. Detachable, pivoting, half skull guard, Slide Flex head band.

1135 Popular 4" window shield. Formed fibre forehead protection pivots over half skull guard. Slide Flex head band.

1140 Excellent wide coverage protection, 8½" detachable window. Heavy duty adjustable window, maximum ventilation.

Built for Better Service

Dockson Featherweight Face Shields are designed and constructed to meet every requirement of safety and comfort. Light, well ventilated and sturdy, these nationally known face shields provide maximum protection on the job for which they are designed.

Wide vision Cellulose Acetate windows, bound in rustproof metal channels. Comfortable molded head gears with felt cushioned, leatherette pads are only two of the many features which make Dockson Face Shields the choice of the man who wears them.

Write for complete information and catalogue.

DOCKSON CORPORATION
3839 Wabash • Detroit 8, Mich.

Welding equipment exhibit of Airco Export Corp. features latest welders, flame-cutters, etc.

Airco Export Corp. Opens Permanent Products Exhibit

AIRCO Export Co., a subsidiary of Air Reduction Co., Inc., has opened a permanent products exhibit in connection with its main office at 33 West 42nd St., New York City, to demonstrate its products to buyers and representatives from abroad. Of particular interest to the welding industry are the displays of a-c and d-c welders, portable oxy-acetylene welding and cutting outfits, and latest flame-cutting machines. All accessories for gas welding, cutting, flame-hardening, flame-cleaning and for electric arc welding are displayed.

☆ ☆

Preheating Produces High-Tensile Flash Welds

AN interesting report prepared by staff members of the Battelle Memorial Institute, Columbus, O., covers flash welds in tubing and rods. The investigators found that heat treating ½-in. tubing to a tensile strength of 150,000 psi before flash welding resulted in joints as strong as the parent tubing. However, heat treating to strengths of 180,000 psi or higher produced welds with less strength than the original tubing. The same was generally true of flash welds in solid round bars.

This report (PB-16472) is now on sale by the Office of the Publication Board, Department of Commerce, Washington 25, D. C. Orders for it should be accompanied by check or money order (photostat $5; microfilm, $1; 64 pages), payable to the Treasurer of the United States.

☆ ☆

Power Show Scheduled December 2 to 7

THE 17th National Exposition of Power and Mechanical Engineering will be held in Grand Central Palace, New York, the week of December 2 to 7, in conjunction with the meeting of American Society of Mechanical Engineers. Exhibition space on four floors will be occupied by more than 300 leading manufacturers. The show will consist of equipment for the production of power from fuel, power transmission and some phases of power utilization.

☆ ☆

Thomson Changes Firm Name

THOMSON ELECTRIC WELDER Co., 161 Pleasant St., Lynn, Mass., is the new name of the former Thomson-Gibb Electric Welding Co. The change in name is a move toward a shorter, simpler, more exact identification. No changes have been made in management, personnel, location, etc.

T. A. S. Offers Welding Information

TECHNICAL Advisory Service of Smaller War Plants Corp. has published several technical books containing helpful information for various industries. Among those of interest to the welding field are: Better Welding Method (2-185-Weld), Automatic or Semiautomatic Method for Welding Steel Parts (2-101-Weld), Flux for Welding Copper to Copper and to Steel (3-428-Weld), Gas Welding of 24-S Aluminum Alloy (2-262-Weld) and Welding Aluminum Rods on Stainless Steel (3-120-Weld). To obtain copies of these reports, address Smaller War Plants Corp., Washington 25, D. C. or the nearest SWPC regional office. Full key numbers (shown in parentheses) should be given.

☆ ☆

ASM Grants Charter to Atomic Physicists

THE American Society for Metals has granted a charter to thirty-seven metallurgists, physicists, chemists, engineers and technicians engaged in the atomic-bomb project for the formation of the Los Alamos (New Mexico) chapter of the society. This is the 69th ASM chapter within the United States and Canada and brings the Society's membership to more than 20,000.

Los Alamos Chapter officers include Frank Kubosch, chairman; Harvey L. Slatin, vice-chairman; James N. Taub, secretary and Harold H. Hirsch, treasurer. Trustees are Walter F. Arnold, Gerald Tenney, William W. Wellborn, Eric R. Jette and Rex Peters.

☆ ☆

National Tube to Install New Facilities in Two Plants

PLANS have been made for an extensive program of improved facilities at the plants of National Tube Co. at Lorain, O., and Gary, Ind. The new equipment will enable the company to meet the estimated future demands for steel pipe.

A new Bessemer steel plant, including three Bessemer converters and all necessary auxiliary equipment, will be installed at Lorain. Plans also include the installation of an additional mill to produce seamless pipe in the smaller sizes.

At the Gary plant an additional seamless mill for the production of small-size pipe will be installed as well as resistance welding equipment for producing tubing up to 5 in. O.D. Completion of the two projects will require about two years.

☆ ☆

Electronic Conference October 3 to 5, Chicago

THE SECOND national electronic conference will be held at the Edgewater Beach Hotel in Chicago, Oct. 3 to 5. The gathering is sponsored by the Illinois Institute of Technology, Northwestern University, and the Chicago sections of AIEE and IRE with the coöperation of the Chicago Technical Societies Council and the University of Illinois. Morning, afternoon and evening sessions are scheduled for each of the three days.

Corp Brothers Changes New Bedford Location

CORP BROTHERS Co., producers of welding equipment and materials, has moved its New Bedford branch at 9 Chestnut St. to 74 No. Second St. A new branch has also been opened at 126 Morgan St., Fall River, Mass.

☆ ☆

Complete Safety Code for High-Voltage X-rays

THE American Standards Association War Committee has compiled a safety standard for the industrial use of X-rays that represents the first codification of safety requirements in this field. The first part of the code covers general protection, and the other five parts deal with the use and storage of radium in the field of industrial radiography, methods and materials of X-ray protection, specific applications for machines of 400 kv and lower, protection for 1,000,000 and 2,000,000 volts and electrical protection.

☆ ☆

AISC Opens District Office

AMERICAN INSTITUTE of STEEL CONSTRUCTION, INC., has opened a new district office at 1617 Pennsylvania Blvd., Philadelphia 3.

EITHEREND
Cable Connector
CAT.4472
CAT.4472
For simple cable connectors that are unequalled in the welding connector field use ANDERSON EITHEREND. Eitherends are neither male nor female . . . no need to hunt for mating ends.
Fabricated of specially tempered admiralty tubing.
Consider these advantages.
Large Surface, Wiping-Action Contact.
Efficient, POSITIVE Connection.
Resilient, Self-Cleaning Contacts Never Need Dressing.
Built To Take Constant Hard Usage.
Strong, Durable Connections.
Economical — No Need To Throw Away Damaged Cable or Short Ends — Splice them with EITHEREND.
Available, when specified, with full protecting insulating sleeves.
Available with or without locking hooks.
Write for detailed information on the Eitherend . . . and other dependable welding equipment.
ALBERT & J. M. ANDERSON MFG. CO.
305 A STREET
BOSTON 10, MASS.

U. S. Steel Supply Resumes Operation of Boston Warehouse

After more than 3½ years' service with the U. S. Navy, the Boston warehouse of U. S. Steel Supply Co. has returned to peacetime operation. Plans are being made to build up substantial stocks of steel and steel products for New England consumers.

☆ ☆

Pennsalt Begins Construction of $1,000,000 Chemical Plant

In order to serve the increasing industrial activities in the Portland, Ore., area, the Pennsylvania Salt Mfg. Co. has begun construction of a new $1,000,000 chemical plant on the Willamette River. The unit is expected to be in operation about June 1, 1947. It will produce liquid chlorine, liquid caustic soda, sodium chlorate, potassium chlorate, and sodium hypochlorite.

☆ ☆

BEA-Register Re-Opens Services for Subscribers

The British Engineer's Association, London, has reopened its Register for new members after an interval during the years of war. Full particulars of membership are available on application to the British Engineers' Association, 32 Victoria St., London, S.W. 1.

☆ ☆

Sciaky Vacations August 10 to 25

Plant employees of Sciaky Bros., Inc., will take their annual vacation from Aug. 10 to 18 to permit necessary factory maintenance work. No deliveries will be received during this week. A skeleton crew will be on hand to handle emergency repair parts service.

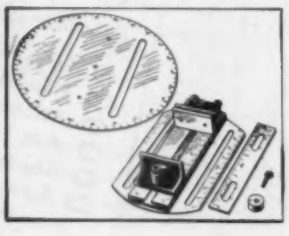
Company offices will be closed for the two week period, Aug. 10 to 25 for the same reasons.

☆ ☆

Coupling Co. Acquires Ideal Transmissions

Lovejoy Flexible Coupling Co., 5001-5009 W. Lake Street, Chicago 44, has acquired in entirety, the manufacture and sales of the mechanical power transmission department of Ideal Industries, Inc., Sycamore, Ill. Products thus affected are: Ideal variable speed pulleys, adjustable motor bases, "Select-O-Speed" transmissions, Ideal drive sheaves and a stock of wide V-belts.

New, Simplified Drill Press Vise, Speeds Up Drilling, Spacing, Milling



Designed to be used with a drill press table having either parallel or radial slots, the New UNI-VISE drill press vise, with guide bar and protractor disc, speeds up and simplifies drilling, layout and spacing work in straight lines, radial or circular. With two movable jaws, vise has universal movement without swinging table or head of drill press to locate exact position of work. Operator thus adjusts work quickly for accurate registration.

Guide Bar facilitates drilling holes in a straight line. With a straight edge and a lineal scale on surface, it registers with lineal scale of vise. Protractor disc, for drilling holes accurately in a circle, has parallel slots registering with parallel slots in base of vise, and a removable means to pivot complete unit on table of drill press.

Accurate work can always best be done by attentive operators. That's why many factories urge workers to chew gum. The chewing action helps relieve monotony—helps keep workers alert, thus aiding them to do a better job with greater ease and safety. And workers can chew Wrigley's Spearmint Gum right on the job—even when hands are busy.

You can get complete information from Spiral Mfg. Corp. 3612-26 N. Kilbourn Ave., Chicago 41, Ill.

AA-83

About People

Clifford M. Manzer, formerly in charge of research, development and manufacturing processes on resistance welding at the Lynn, Mass., plant of General Electric Co., has been appointed chief engineer of Progressive Welder Co., Detroit. He is in charge of all company engineering activities. Walter L. Jewett, chief engineer for Progressive for the past nine months, has been appointed manager of development engineering.

☆ ☆

Eugene W. O'Brien, vice-president of the W. R. C. Smith Publishing Co., Atlanta, has been nominated as next president of The American Society of Mechanical Engineers. Named for regional vice-presidents are: Alton C. Chick, assistant vice-president of the Manufacturers Fire Insurance Co., Providence, R. I., A. R. Mumford, development engineer with the Combustion Engineering Co., New York, E. E. Williams, general superintendent of steam plants, Duke Power Co., Charlotte, N. C. and T. S. McEwan, vice-president, McClure, Hadden and Ortman, Inc., Chicago.

☆ ☆

Benjamin F. Fairless, president of the U. S. Steel Corp., was recently awarded the Medal of Merit by the War Department in recognition of his voluntary service as advisor to the Army's Chief of Ordnance on wartime problems of management, production and supply.

FACTS WORTH NOTING

RUFLUX S

WELDING ROD COATING

Known for its arc stabilizing properties—RUFLUX S is a sodium titanate containing approximately 80% T_1O_2 and 15% Na_2O. Specific gravity 3.93, mesh size-plus 200, and weight per cubic foot 48 lbs.

Included in welding rod formulation—it aids in speeding welding operations and helps assure proper slag formation.

TAM

TITANIUM ALLOY MANUFACTURING COMPANY

Executive Offices: 111 Broadway, New York City *General Offices and Works:* Niagara Falls, N. Y.

STOPS Damage to Your WELDERS from Dirt and Grit!

BADGER Filter for "P & H" Welder

HERE'S INSURANCE against excessive "down-time" stoppages resulting from damage to your Welder parts resulting from process and atmospheric dust . . . Protection from production losses, man-hour losses, repairs and expense. By installing BADGER Permanent Filters, a single user saved as much as 160 man-hours on each unit in his plant. Similar savings are possible on your own Generator Welding units.

BADGER Permanent (Cleanable) Filters are made for all popular styles of Welders — Lincoln, GE, Hobart, P & H, Westinghouse, Wilson, and others.

Write or Wire for Full Information

Badger CORPORATION

335 E. BROWN ST. • MILWAUKEE 12, WIS.

...for welding ALUMINUM and all non-ferrous metals..

The characteristics of the arc flame are ideal for welding aluminum, brass and other non-ferrous metals . . . for welding and brazing metals previously considered "unweldable".

BBB Keen-Arc Carbons — cored and heavily copper coated — were developed *specifically* for Arc Torches. The 9000° F. flame (2000° hotter than oxy-acetylene) is non-wandering and concentrated at the desired focal point — produces a fine grained weld, free from pin holes and of high tensile strength.

Write for literature and samples.

B·B·B Stands for Quality ... KEEN-ARC CARBONS

BECKER BROTHERS CARBON CO. 3450 So. 52nd Ave. Cicero 50, Ill.

J. W. SHEFFER has been appointed general improvement engineer of the American Car and Foundry Co., N. Y. He will be in direct charge of the improvement division with headquarters in New York. E. A. WATSON will be Mr. Sheffer's assistant. H. F. SCHWARTING has been named general electrical engineer, with headquarters in St. Louis.

☆ ☆

LT. COL. SIR JOHN HENRY MAITLAND GREENLY, chairman of Babcock & Wilcox, Ltd., in London, recently received the British Institute of Metals platinum medal. The honor, voted unanimously by the Institute's Council, was in recognition of Sir John's outstanding services to the non-ferrous metals industry.

☆ ☆

KENNETH A. MOODY has been appointed training director of the American Steel & Wire Co., Cleveland. Mr. Moody was identified with personnel and training education in the company from 1937 until his departure for military service in Dec., 1943.

☆ ☆

GEORGE R. WERMISCH has been appointed manager of the steel joist and roof-deck division for Ceco Steel Products Corp., Chicago. He will make his headquarters at Ceco's general offices and plant No. 1 in Chicago.

☆ ☆

DR. JOHN F. GALL has been appointed assistant research supervisor to assist in the coördination of the experimental activities of the research division of the Pennsylvania Salt Mfg. Company's research and development department.

☆ ☆

HAROLD L. ALDRICH, formerly with United Color & Pigment So., division of Interchemical Corp., has been appointed district representative in the New York office of the General Electric chemical department. He will be G-E sales representative for Glyptal-alkyd resins.

☆ ☆

CHAMP CARRY, executive vice-president of The Pullman Co. since 1941, has been elected president of The Pullman-Standard Car Mfg. Co. He succeeds C. A. LIDDLE, who was elected chairman of the board of Pullman Standard.

☆ ☆

R. M. WILSON, JR., formerly welding engineer at the Bloomfield, N. J., office of the General Electric Co., has joined the technical service of the development and research division of International Nickel Co., Inc., N. Y., in the same capacity.

☆ ☆

R. H. MACGILLIVRAY has been appointed regional supervisor of the Pacific coast area for Westinghouse Electric International Co. His headquarters will be in San Francisco.

RUDOLPH WALTER, formerly of General Electric X-Ray Corp. and Dean Payne have joined the sales staff of the Bastian-Blessing Co., Chicago. Both men have had several years experience in the sales and engineering departments.

☆ ☆

THOMAS G. FRANZREB and DONALD KEATING have joined the technical service division staff of Turco Products, Inc., Los Angeles. They will specialize in the solution of problems relative to the railroad field.

☆ ☆

A. A. RORISON has been appointed general auditor for the Douglas Aircraft Co. Before entering military service Mr. Rorison was manager of the Los Angeles zone office of the General Motors truck and coach division.

☆ ☆

CLYDE WILLIAMS, director of Battelle Institute, Columbus, O., has been presented the honorary degree of Doctor of Science in recognition of his wartime and peacetime contributions to American technology.

☆ ☆

ERNEST C. HUEHNER, manager of the central office supply bureau of Carnegie-Illinois Steel Corp., was recently awarded the Gary 50-year service medal in recognition of his long service.

☆ ☆

GEORGE A. LENNOX has been appointed vice-president in charge of sales of the Driver-Harris Co., Harrison, N. J. JOSEPH B. SHELBY has been named assistant vice-president in the same department.

☆ ☆

ROBERT S. GREEN has become president of the A. P. Green Fire Brick Co., Mexico, Mo. He succeeds his father, ALLEN P. GREEN, who moves to the post of chairman of the board.

☆ ☆

ALVIN L. KRIEC, recently discharged from the U. S. Army, has joined the public relations department of the American Steel & Wire Co.

☆ ☆

ARTHUR W. JOHNSON has been promoted assistant manager of sales in the Chicago district for U. S. Steel Supply Co.

Died . . .

LEROY W. HUTCHINS, president of Sheldon, Morse, Hutchins and Easton, Inc., New York, died recently after a prolonged illness. Mr. Hutchins was also president of Hutchins & Graves, Inc., advertising agency, and managing director of Safety Research Institute, Inc.

☆ ☆

ROBERT S. HOFFMAN, president-treasurer of the Hoffman Bronze & Aluminum Castings Co., died July 5 after a prolonged illness.

Fuse-Well Cast Welding Rods

THE STANDARD OF QUALITY
Throughout the World

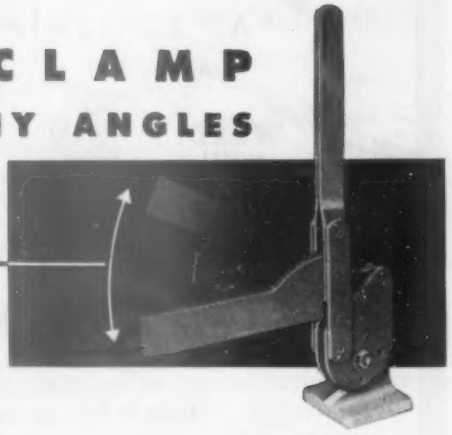
CAST ALUMINUM
WELDING RODS
OF STANDARD ANALYSIS

PLAIN AND ALLOYED GRAY IRON
WELDING RODS
AND ELECTRODES

THE CHICAGO HARDWARE FOUNDRY CO.
Dependable Since 1897
846 ENGINEERING BUILDING
NORTH CHICAGO, ILLINOIS

This ONE CLAMP GIVES YOU MANY ANGLES OF CLAMPING

PROVIDES RANGE OF CLAMPING TO 45° WITH SAME MOUNTING



If you are required to clamp work at different angles from job to job, you should have a KS Model Knu-Vise toggle-action clamp—one of the most versatile clamps made.

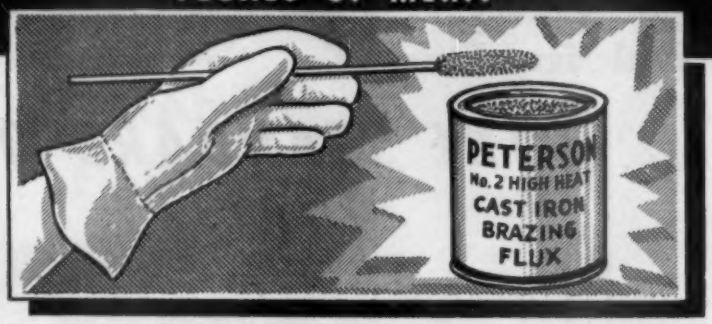
By means of an ingenious tear-drop shaped sideplate this clamp permits change of toggle bar to any angle up to 45° without disturbing fixed base. Simply drill a hole in upright plate of base (through hole already provided) at required angle of toggle bar to work—then set with dowel.

Made in 3 sizes to meet wide range of applications—accommodating pressure loads from 650 to 1200 pounds.

KNU-VISE INCORPORATED
2207 Eighth St. Detroit 16, Michigan
4328 San Fernando Rd. Glendale, Calif.

WELDING **PETERSON** BRAZING

"FLUXES OF MERIT"



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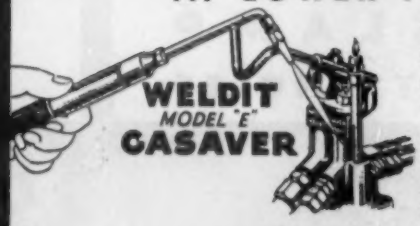

The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

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The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

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Helpful Literature Just Published

Unless otherwise stated, the publications reviewed in this section may be obtained without cost by writing to the manufacturers listed.

Guide for Automotive Flash-Butt Welding

A new 24-page, 6 by 9 in. AWS handbook (D8.1-46T) gives tentative recommended practices for automotive flash-butt welding. The six sections of this comprehensive manual deal with material, equipment, design, tooling, technique and inspection. Each section is supplemented by drawings to facilitate the understanding of the text. Data are listed for the flash-butt welding of solid (round, hexagonal and rectangular) bars, tubing and flat sheets. Copies of this handbook, "Recommended Practices for Automotive Flash-Butt Welding," may be purchased from the AMERICAN WELDING SOCIETY, 33 W. 39th Street, New York City 18, at 30c per copy.

☆ ☆

Maintenance Booklets

THREE new booklets, each available in Spanish and English, give helpful information on automotive and aircraft maintenance and industrial metal cleaning. Bulletin AS-362, "How to Speed and Simplify Cleaning Methods in Industrial Plants," covers rust removal, water-scale elimination, steam cleaning, paint stripping, metal surface treatment and general maintenance. Bulletin AS-363, "How to Reduce the Cost of Automotive Maintenance Through Turco Methods," deals with all phases of motor chassis cleaning. Bulletin AS-364, "How to Reduce the Cost of Aeronautical Maintenance," covers the entire field of aircraft cleaning. TURCO PRODUCTS, INC., EXPORT SALES DIVISION, P.O. Box 2649, Terminal Annex, Los Angeles.

☆ ☆

Welding Data Chart

AN 8½ by 11 in. stainless-steel electrode chart that folds into a two-color cover lists the various AISI alloy steels and electrodes for welding them. Trade names are given for each AISI number and the proper electrode for welding each specific type. In general an electrode of the same analysis as the steel is selected. However, information is given for instances where the correct electrode differs from the base metal. Also included is a portion of a reference chart on high-alloy and low-alloy welding. The complete chart, which may be obtained on request, includes tables on corrosion resistance, heat resistance, weld-metal facing, welding currents and voltages. ARCOS CORP., 1515 Locust Street, Philadelphia 2.

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FARM and SERVICE STATION PORTABLE A. C. WELDERS

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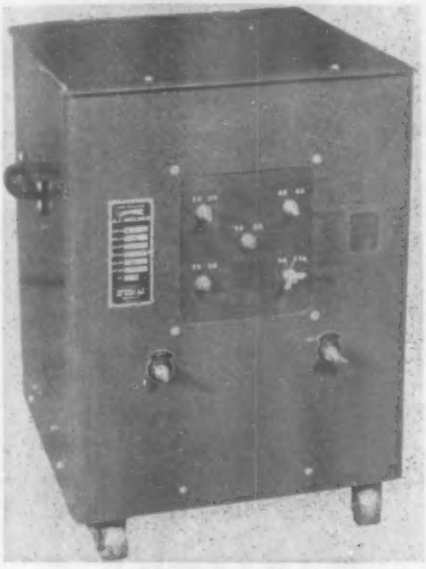

Model N115 Exterior View

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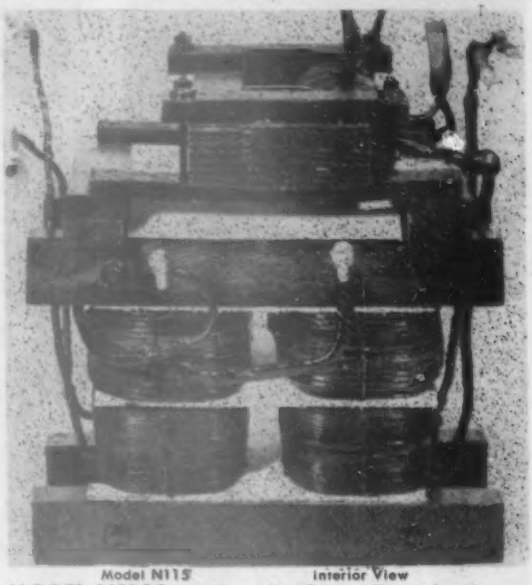
Model N115—Has a New Power Packed Multiple-Coil Transformer, Features 4 Coils Instead of 2. Also Separate Reactance, Double-Woven Spun-Glass Insulated Magnet Wire. 15 to 115 Amperes.



Model N115 Interior View

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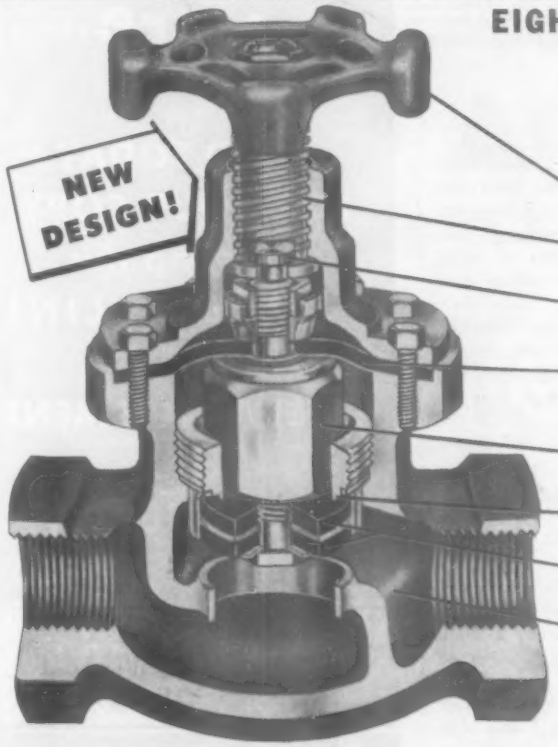

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Electrode for "Problem" Steels

A 16-page bulletin describes the Murex HTS electrode designed to prevent underbead cracking in the welding of "difficult-to-weld" steels. The text asserts that this electrode, which combines a lime-based flux coating with a mild-steel core, will weld successfully such ordinarily troublesome materials as high-sulphur free-machining steels, high-carbon and alloy steels, cold-rolled steels, cast iron and malleable iron. Tables give full data on the physical properties and chemical analysis of the deposited weld metal. A tabular comparison is also made of the as-welded deposition characteristics and physical properties of E-6010, HTS and E-6020 electrodes. Another section of the booklet discusses specific applications in various industries. METAL & THERMIT CORP., 120 Broadway, New York City 5.

☆ ☆

Electronic Maintenance

PREVENTIVE maintenance techniques designed to maintain top efficiency in electronic control equipment are outlined in a new 6¾ by 3⅞ in. handbook "Maintenance of Industrial Electronic Equipment" announced by Westinghouse. Six basic maintenance operations — cleaning, inspecting, feeling, tightening, adjusting and lubricating — are discussed and applied to vacuum and ignitron tubes, capacitors, resistors, fuses, bushings and insulators, relays, switches, transformers, filter chokes, terminal blocks, meters and other components. Safety precautions to be observed during preventive maintenance operations are also included. Ask for booklet, B-3553. WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, Pittsburgh 30.

☆ ☆

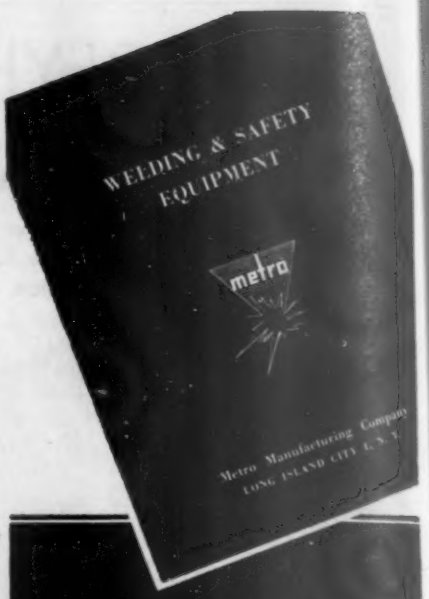
Rod Selector Chart

AN 18 by 23 in. rod selector chart should prove of great value to the shop and plant weldor when he employs low-temperature welding rods. This chart suggests rods for specific jobs, gives properties of welds and procedures for using the various rods with oxy-acetylene, metal-arc (a-c/d-c), furnace, carbon-arc and induction heating. Bonding and remelting temperature, Brinell hardness and strength of welding alloys are also included. This helpful chart may be tacked to a wall or bulletin board for the guidance of all weldors. EUTECTIC WELDING ALLOYS CORP., 40 Worth Street, New York City 13.

☆ ☆

Weldments Booklet

"WELDMENTS" is the title of a new 20-page booklet that presents a comprehensive discussion of the advantages of weldments in modern metal fabrication. The booklet stresses the flexibility of weldments for parts large and small and discusses their requirements and comparative costs. A resumé of the functions of a modern weldery is also given. Numerous photographic reproductions present an impressive picture of the wide range of metal parts and products that may be efficiently fabricated by welding. GRAVER TANK & MFG. CO., INC., 332 S. Michigan Ave., Chicago.



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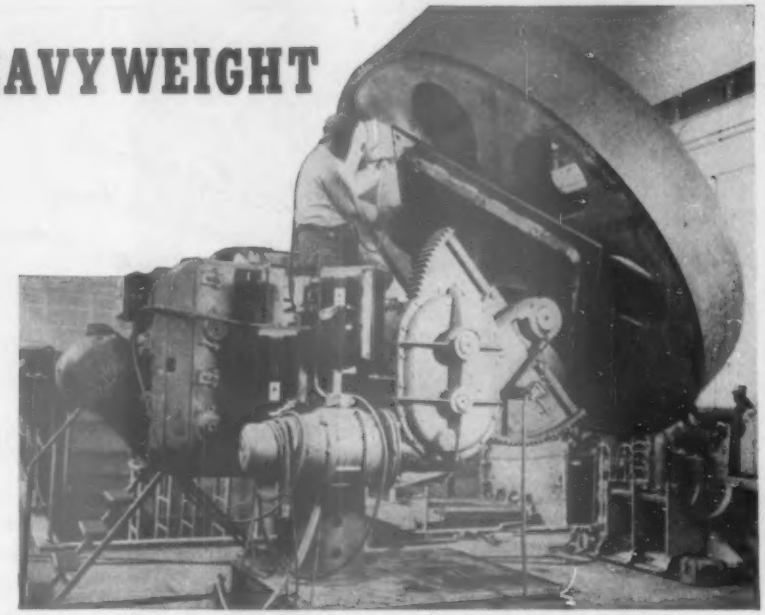

Here is a Model 140 C-F Positioner, handling a large unwieldy weldment with great safety to men and weldment. The weldment is clamped or tack welded to the Positioner table, and is under the positive control of the welder who can tilt the table to 135° from horizontal or to any point at any speed in a circle of 360°. When great weldments are being handled, they are up out of the way—require less floor space and are always under the welders' control.

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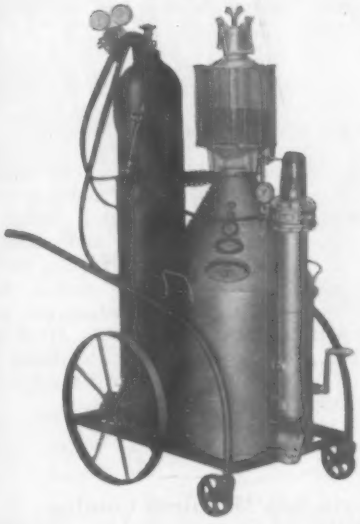

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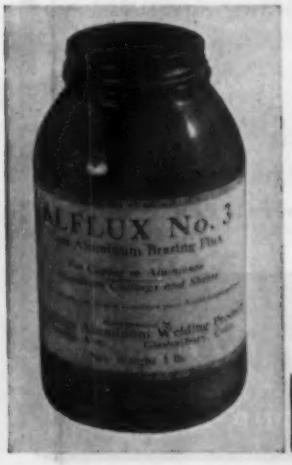

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ALFLUX No. 3 is a multiple purpose flux which has been developed especially

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Mfd. by WOOLDRIDGE ALUMINUM WELDING PRODUCTS, INC. • Glastonbury, Conn.

Arc Welder Booklet

THIS 20-page booklet gives useful information pertaining to the installation, operation, maintenance and overhaul recommendations for motor or belt-driven d-c arc welders. Tables covering weight of these two types, amperage loads, suggested fuse sizes and renewal parts are included. A detailed two-page trouble-shooting chart should prove of great aid to welder maintenance men. A renewal parts price list concludes this valuable little booklet. GENERAL ELECTRIC CO., Schenectady 5, N. Y.

☆ ☆

Building Code Book

A 72-PAGE book published by the AMERICAN IRON AND STEEL INSTITUTE, 350 Fifth Ave., New York City 1, is a condensation of eight reference bulletins covering technical phases of building regulations. Under the general title, "Building Code Modernization," the bulletins include facts related to the purpose and legal limitations of building codes, building classifications, exit regulations, and structural standards covering hot-rolled steel shapes, modern light steel constructions, steel piles (for foundations) and metal veneers. Welding specifications for structural steel are included under the section on "Building Code Regulations."

☆ ☆

Weldor's Pocket Check List

A handy vest pocket check-list that should be of interest to mentally alert plant and factory weldors contains coupons to obtain different literature pertaining to arc welders, welding accessories, electrodes, reference charts, practical design for welding and clothing appropriate for welding. With each item mentioned there is a brief summary of what the literature contains. THE HOBART BROTHERS CO., Box DM-706, Troy 1, Ohio.

☆ ☆

Arc Welder Bulletin

A four-page, letterhead bulletin describes in detail Hobart's new 200-amp welder, which features polarity control, cooling fans, oversize four-pole exciter and multirange control. Information is given on the gas-engine-driven arc welder, electric motor-driven welder, transformer-type a-c welder and the Hobart generator, the latter being used only by individuals who build their own welders. HOBART BROTHERS CO., Box DM-706, Troy 1, O.

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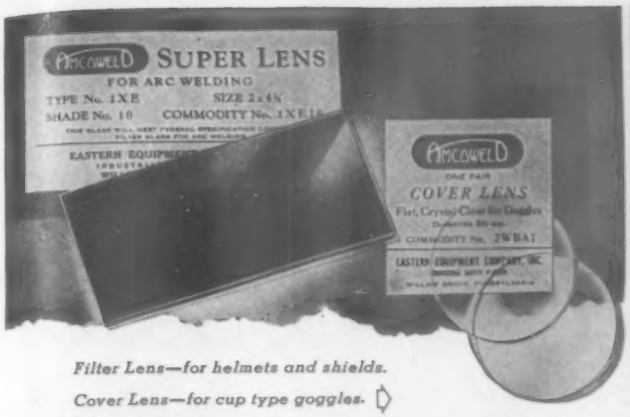
Grinding Machines Catalog

THE complete line of various Norton grinding and lapping machines is described in a 24-page catalog (No. 1843-5). Information in a condensed form is given for cylindrical (automatic and semiautomatic), crankshaft, roll, camshaft, piston rod, car wheel, multipurpose, autopart, tool room, surface and lapping machines. NORTON CO., Worcester 6, Mass.



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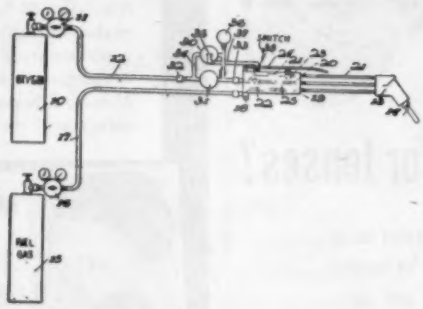
From the Patent Office



Cutting Pressure Regulation

2,399,979. PAUL L. BETZ, Baltimore, assigned to CONSOLIDATED GAS ELECTRIC LIGHT and POWER CO., Baltimore. Filed June 5, 1942. Issued May 7, 1946.

A method for improving the operation of an oxy-acetylene cutting torch. It includes the steps of: (1) initiating and adjusting the flow of preheating oxygen and fuel gas to provide the desired preheat proportions and a predetermined oxygen pressure at the inlet of the torch tip, (2) initiating the flow of cutting oxygen and then increasing the oxygen pressure at the source to restore the predetermined oxygen pressure at the tip inlet, and (3) discontinuing the flow of cutting oxygen and throttling the flow of preheat oxygen at an additional valve to restore the predetermined oxygen pressure. The additional valve is bypassed when cutting oxygen flows. In this manner the predetermined oxygen pressure is maintained when preheating and cutting oxygen flow and also when preheating oxygen alone flows.

☆ ☆

A-C Welding System

2,399,415. ALFRED B. WHITE, Murrysville, Pa., assigned to WESTINGHOUSE ELECTRIC CORP., East Pittsburgh. Filed May 8, 1943. Issued April 30, 1946.

An arc-welding system comprising a welding transformer. The secondary winding is connected to an arc circuit including the welding electrode and work, and primary winding is connected to an a-c power source. An inversely connected valve means controls the instant in each half cycle at which the primary winding is connected so as to provide heat control. This is done by energy storage means connected in shunt relation with the valve means so as to be charged during the non-conducting portion of each half cycle and coupled with the arc circuit independently of the welding transformer so as to discharge through the valve means and produce a single relatively steep wave front impulse between the work and the electrode each time the valve is rendered conductive to connect the primary winding to the source.

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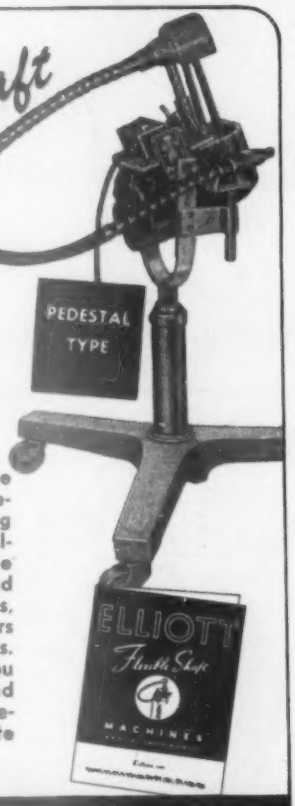

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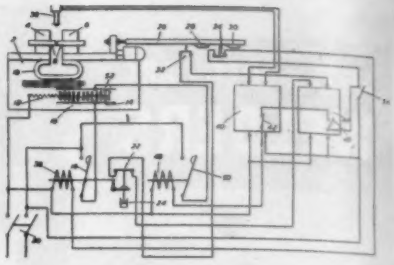

Flash Welder

2,399,453. JAMES MCGREGOR SINCLAIR, Inverness, Scotland, assigned one-half to WILLIAM FORBES YOUNG, Inverness, Scotland. Filed September 27, 1943 (Great Britain, Sept. 21, 1942). Issued April 30, 1946.

An automatic flash-welding machine including a transformer having a multitapped primary winding, a first contactor connecting the source of current supply to one tapping of the primary winding during the welding operation, a second contactor adapted to connect the source of supply to a different tapping of the primary winding, means responsive to movement of the moving head of the machine for opening the first contactor and closing the second contactor at the completion of the welding operation, and means responsive to the temperature of the welded article for actuating the second contactor during a predetermined period to interrupt and alternately re-establish the circuit through the primary winding.

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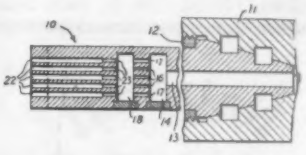

Descaling Torch

2,396,765. GEORGE L. WALKER, Jersey City, N. J., assigned to AIR REDUCTION CO., INC., New York City. Filed Oct. 28, 1942. Issued March 19, 1946.

A tip having an end face, a plurality of jet orifices, a distributing chamber from which gas is supplied to the jets, an initial distributing chamber and a plurality of communicating passages between the distributing chambers. These passages are spaced along a line extending transversely of the tip and are substantially smaller in cross-section than the inlet conduit. Those of the communicating passages directly opposite the gas-inlet conduit are of smaller cross-section than the others.

☆ ☆

Induction-Heating Head

2,399,897. HOWARD E. SOMES, Detroit, assigned to BUDD INDUCTION HEATING, INC., Philadelphia. Filed Feb. 6, 1945. Issued May 7, 1946.

This induction-heating head comprises a coil surrounding a cylindrical support and a magnetic core between the support and coil, extending for a portion of the circumference of the support. At least one of the turns of the coil has a radially outwardly projecting portion parallel to a plane transversely intersecting the axis of the coil.